Electrical World

NOVEMBER 27, 1943

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CUSTOMERS INDICATE PREFERENCES IN POST-WAR LIGHTING

"Murray" – the modern STANDARD in maintenance ladders!

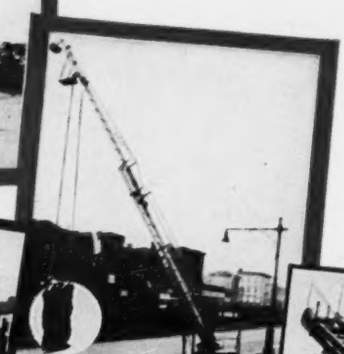
These maintenance units make overhead servicing *so* fast and easy that light output is kept at maximum.

The chief advantage of these Murray Crows'nests is that they make overhead, out-of-the-way lights, unit heaters and sprinkler heads, easily accessible, without disturbing men, machines or production schedules in the slightest.

All the many important plants which have taken on Murray Crows'nests, wonder how any plant ever got along without them. Fill in the coupon and mail—we'll propose a unit suiting your particular needs. Metropolitan Device Corporation, Brooklyn 16, N. Y.

Courtesy "Magazine of Light" General Electric Co.

Courtesy "Magazine of Light" General Electric Co.



Metropolitan Device Corp.
Brooklyn 16, N. Y.

Send data (without obligation) on Murray Crows'nest suitable for our requirements. Ladder must reach feet high, and extend feet side-ways. Aisle width is feet.

Name and Title_____

Company_____

Address_____

Murray crows'nest

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 69 YEARS

November 27, 1943 — Vol. 120, No. 22

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To .....

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Signed .....

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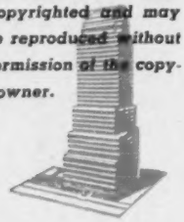

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the rubber shortage doesn't affect this wire

HAZAKROME

SMALL DIAMETER BUILDING WIRE

AVAILABLE FOR WAR-PURPOSE — MAINTENANCE • REWIRING • NEW INSTALLATIONS

HAZAKROME is an approved synthetic insulation containing no rubber. Possessing practically all the desirable qualities of the finest rubber insulation, HAZAKROME also offers many features that rubber lacks — particularly non-inflammability and resistance to oil, moisture, ozone and atmospheric conditions.

Consisting only of copper and a thin layer of insulation, HAZAKROME wires are easier to handle, splice and connect than Type R wire. HAZAKROME is particularly useful for rewiring jobs, where its small diameter increases the capacity of existing conduit by as much as 2 and 3 times — thus eliminating the expense of conduit changes, plastering and redecorating.

With the use of natural rubber forbidden in the manufacture of wire for most commercial applications, HAZAKROME has become a timely and welcome alternate. Its use is permitted in applications where copper is allocated.

HAZAKROME wires fully meet the rigid safety requirements of the 1940 National Electrical Code. Write today for your copy of Bulletin 200 — THE HAZAKROME HANDBOOK.

HAZAKROME FEATURES—

- A complete range of sizes for both lighting and power-circuits.
- Resistant to moisture, oil, chemicals and flame.
- Smooth, glossy and lubricated surface — easy pulling.
- Available in non-fading, standard building wire colors.
- Chemically stable and long aging.
- Tough insulation — a tensile strength of 2000 lbs. per sq. in.
- Free stripping — easy to install.
- No outer covering required.
- Small diameter — permits greater conduit fill.

CONSIDER HAZAKROME FOR BUS-DROP CABLES TOO

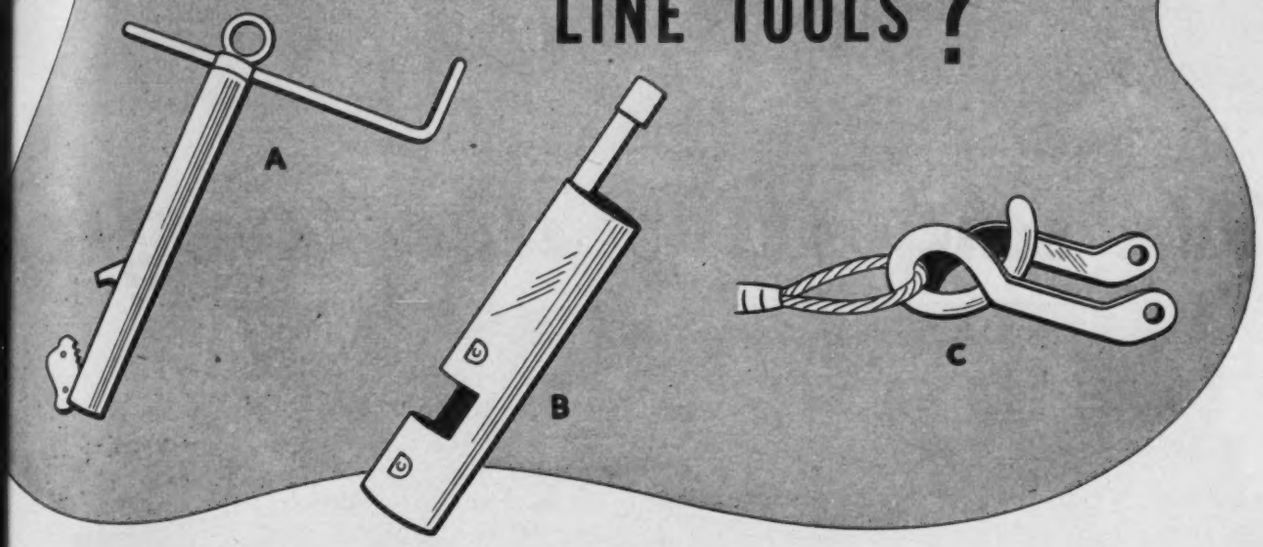
Developed to meet the widespread use of bus-duct systems in factories, HAZAKROME Bus-Drop Cable will bring power to individual machines — *quickly* and at *low cost*. No conduit and no pulling is required. Ordinary squeeze-type armored cable fittings and porcelain hangers can be used. » » HAZAKROME Bus-Drop Cable consists of 3 stranded conductors, insulated with color-coded HAZAKROME, and three small stranded ground wires equivalent in cross-section to one power conductor. These are cabled with necessary jute filler, covered with tape and a final HAZAKROME jacket.

HAZARD INSULATED WIRE WORKS
DIVISION OF THE OKONITE COMPANY
Works: Wilkes-Barre, Pa. • Offices in Principal Cities

ARMY E NAVY

HAZARD Electrical Wires and Cables

Quiz: WHERE WOULD YOU USE THESE LINE TOOLS?



To Keep Fully Informed on Time-Saving Tools Keep in Touch with your Graybar Man

● Tools are precious these days. Those you now have in service which are well engineered and soundly constructed are paying extra dividends in man-hours saved.

This adds new point to the long-term GRAYBAR policy of offering high-quality tools *specially built for line construction and maintenance work*, overhead or underground.

And today, even though tool sales are restricted, GRAYBAR is keeping fully informed on what's new and what's best for time-saving efficiency on the job. Experienced Representatives can "talk tools" intelligently, suggesting the items which best meet your own conditions from a score of different suppliers.

As a current source of essential supply, or as a "tools advisor" for your long-term planning, GRAYBAR is ready and well equipped to serve you.

Here are the ANSWERS (INVERT PAGE)

(a) **Temporary Guy Clamp,** with vise screw enclosed in a steel magazine, unusually efficient for necking guy wires close to the pole. (b) **Pick up,** for use within underground conduit. Recovers rods or tools. Also useful on long pulls when it is desirable to work from both ends. (c) **Safety hook** for raising derrick to operating position. Line is passed over spindle bar, threaded through derrick sheave, and attached to safety hook.

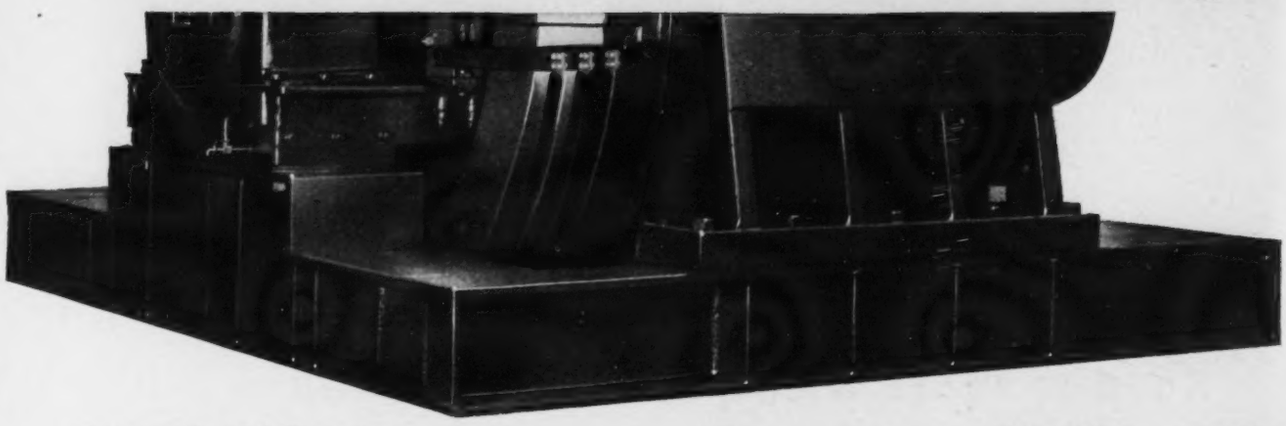
Everything Electrical . . . . THAT IT TAKES TO WIN!

GraybaR

IN OVER 80 PRINCIPAL CITIES

EXECUTIVE OFFICES: GRAYBAR BUILDING, NEW YORK 17, N. Y.

We said *they are tough!*



One reason these big Elliott motors have earned a reputation for exceptional stamina, is because they are so often found in specially difficult drives, in unusual applications. Elliott engineers have for years specialized on motor design for this type of service, and will have something of value to suggest, should you be in the market for motors of this character.

Remember PEARL HARBOR

WELL . . . when the job of rehabilitation was at its frenzie height, we received a wire from there identifying a certain Ellio motor installed on a dredge, and asking its absolute, maximu rating, as it was running hot at 6000 hp.

The rating of that motor is 2500 hp!

There it was, groaning along at almost two and a half tim its rated capacity, handling some pumping job of dire eme gency, helping to bring order out of chaos, to lighten as far it could one of the black pages in American history.

Whether it be men or motors, times of crisis and bitter nee bring out those reserves of strength and fortitude which indica exceptional character. We are glad when Elliott motors a put to this test.

A star has been added to the Army - Navy "E" flags flown by both the Jeanette and the Ridgway plants of Elliott Company.

ELLIOTT MOTORS

ELECTRIC POWER DEPARTMEN

RIDGWAY, PA.

DISTRICT OFFICES IN PRINCIPAL CIT

CHECK the FACTS

1. Designed for high strength and high conductivity - with a proper use of metal.
2. For every need - from small cable clamps to heavy duty power connectors - R&IE standard or designed fittings meet all requirements.
3. The quality of R&IE fittings is measured by long years of continuous service on small circuits or large, critical, industrial buses.
4. All business is big business to R&IE - one or one hundred fittings receive equal attention in design and production.

The Check List

- CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- AIR BREAK SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC SECTIONALIZING EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES

R&IE

CONDUCTOR FITTINGS

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

CANADA—EASTERN POWER DEVICES, LIMITED, TORONTO

Off-the-record

BULK OF WAR-BORN DEVELOPMENTS IN ALLIS-CHALMERS POW

MOST CRUCIAL APPLICATIONS TODAY . . . BUT, AS IDEAS HEY

☛ Chances are power gas turbines are going to revolutionize power plants of the future . . . but they won't start doing it till after the war.

They're being built at Allis-Chalmers, yes . . . but only for such super-top priority uses as high octane gasoline cracking plants. Here they supply low pressure air to catalyst towers . . . operate on returned hot process gases otherwise wasted!

We can't tell you how many we've built—or are building today—but the total may be greater than for the rest of the world combined.

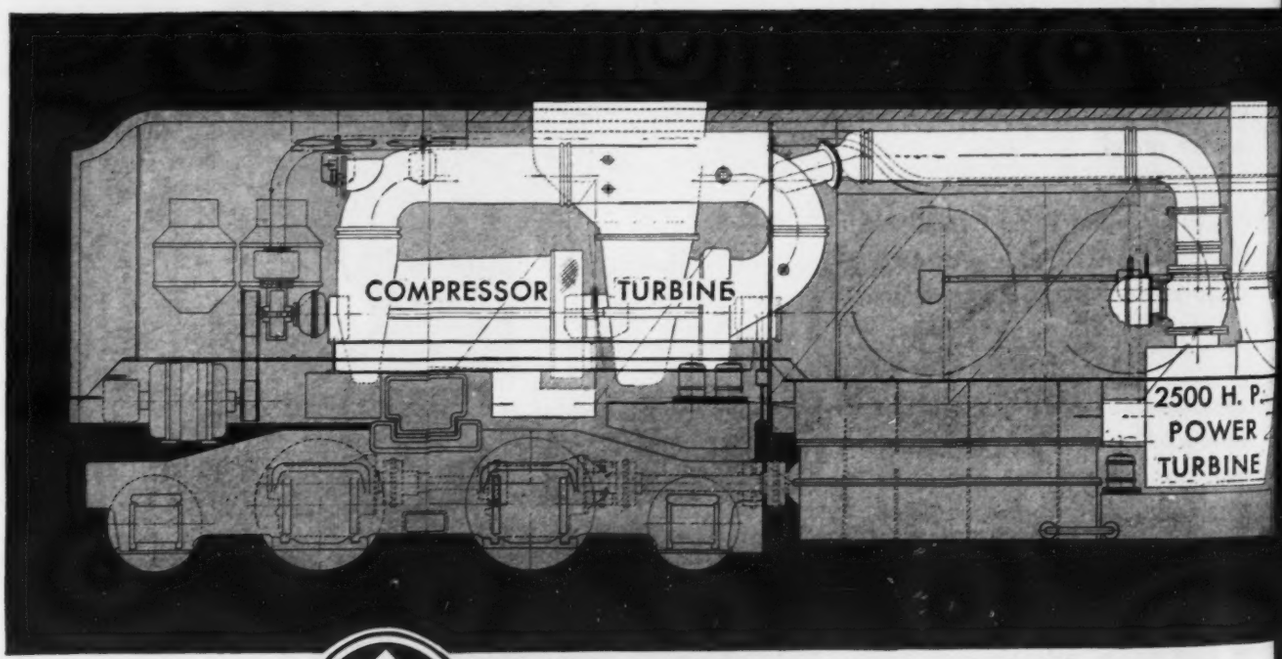
And during this time when turbine-building facilities are choked up with gas turbines, marine turbines and essential power system turbo-generator units, Allis-Chalmers research engineers are setting the manufacturing stage to make power gas turbines a postwar reality.

High-speed, rotating prime movers driven directly from combustion gases will come . . . in compact, low operating cost power gas turbines!

So the picture is this: don't even think about sending in an order for a power gas turbine today. We're snowed under with present turbine commitments. BUT . . . don't forget gas turbines for a minute in your post-war planning. As a stimulator, note below how well the compactness, efficiency and simplicity potentialities of a gas turbine fit with locomotive requirements.

☛ Billions of d-c kilowatt-hours per year . . . are streaming to wartime aluminum, magnesium and chlorine electrolytic cells from thousands of single anode mercury arc rectifier tanks.

PROPOSED 5,000 HP, 120 MILE PER HOUR PASSENGER LOCOMOTIVE (OF THE FUTURE) DRIVEN

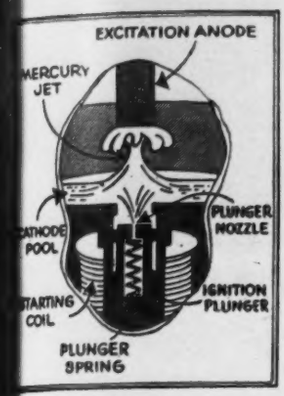


A-C WE WORK FOR VICTORY WE PLAN FOR PEACE

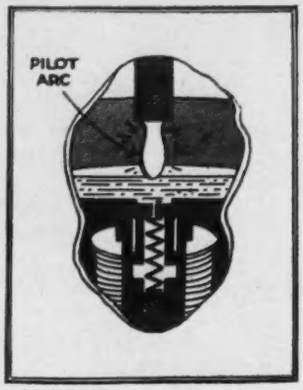
ALLIS-C

ideas for 194X

POWER AND ELECTRICAL EQUIPMENT MUST GO ONLY INTO
THEY BELONG IN BACK OF EVERY POSTWAR PLANNER'S HEAD



1—IGNITION



2—EXCITATION

Not all these rectifiers are alike. Allis-Chalmers "Excitrons" are continuously excited . . . have added simplicity and reliability.

Here's the simplicity: when an Excitron goes on the line, in each tank—

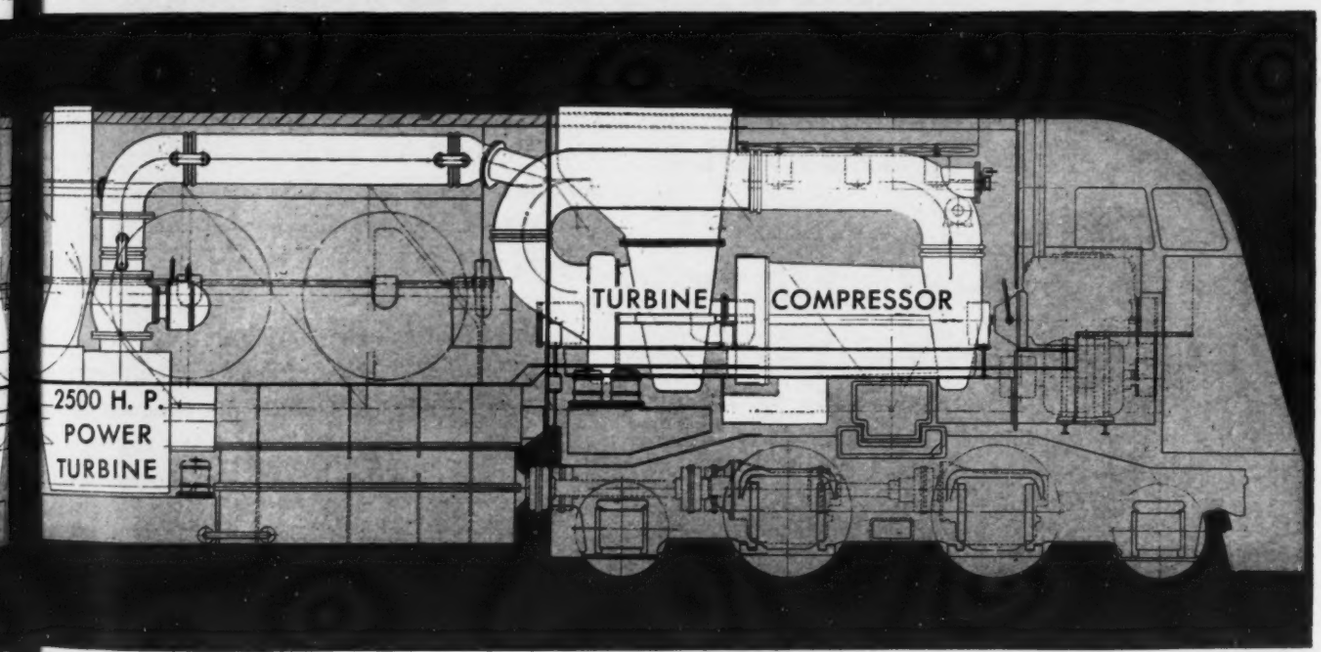
1) A solenoid-operated spray device squirts mercury to the excitation anode . . . collapsing jet starts pilot arc; 2) Pilot arc then maintains a cathode spot during Excitron operation, emitting electrons to prime main arcs for "firing when ready."

Here's the reliability: excitation d-c is backed by 3-phase a-c from the line; single phase disturbances can not affect excitation stability. Ignition and excitation involve simple d-c circuits; no unfamiliar electrical auxiliaries to cause trouble. Write for "Questions and Answers on Excitron Continuous Excitation," Leaflet B-6301.

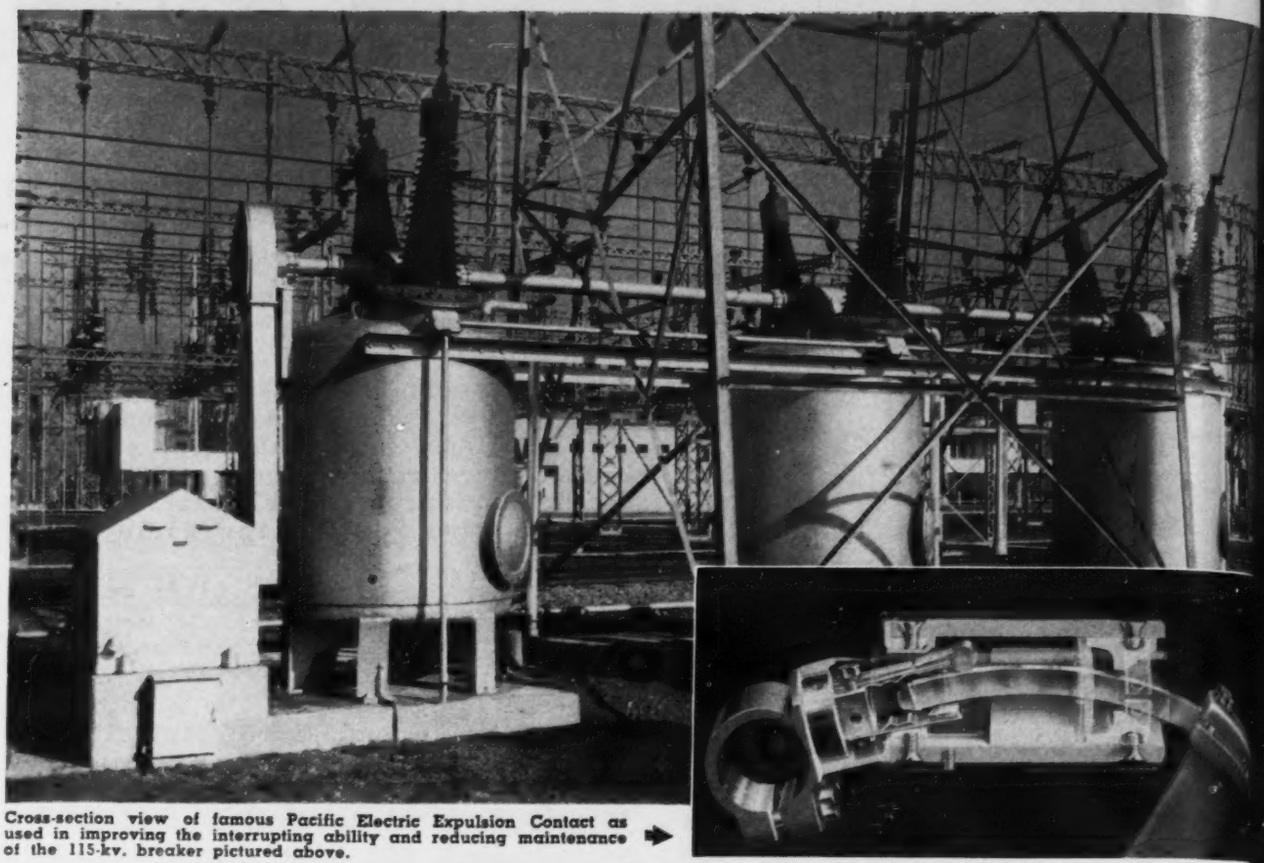
Look for other important new developments in electrical and power equipment from Allis-Chalmers. Maybe we can help you — maybe you can help us. ALLIS-CHALMERS, MILWAUKEE, WIS.

A-1671

Y GAS TURBINES. HIGH POWER PER UNIT OF SPACE. 10 HOUR RUNS WITHOUT REFUELING



CHALMERS



Cross-section view of famous Pacific Electric Expulsion Contact as used in improving the interrupting ability and reducing maintenance of the 115-kv. breaker pictured above. ➡

MODERNIZE OLD BREAKERS *to protect* WAR LOADS . . .

PACIFIC ELECTRIC EXPULSION CONTACTS IMPROVE INTERRUPTING ABILITY, CLEAR FAULTS FASTER . . .

You can save maintenance man-hours, save critical materials and improve the performance of old P. E. Breakers by Modernization with the well-known Pacific Electric Expulsion Contacts. Your same breakers will then protect heavier loads—at less maintenance costs.

The Expulsion Contacts clear arcs faster. That permits shorter tripping time and the interruption of more fa with less maintenance. Contacts last longer, oil c bonization is greatly reduced.

Many older P. E. Breakers have already been impro to meet increased duty.

Ask us about this time-saving, money-saving mod ization, listing the number of Pacific Electric breakers consider modernizing together with their size and s numbers.

C. H. CUTTER
1015 Securities Bldg.
Seattle, 1, Wash.

G. B. KIRKWOOD
437 S. Hill St.
Los Angeles, 13, Calif.

A. A. MARRS
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Kansas City, Mo.

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Phoenix, Ariz.

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Pacific Electric Mfg. Corporation

5815 THIRD ST., SAN FRANCISCO, 24, CALIF. DUNES HIGHWAY, GARY, INDIAN

4 WARTIME SERVICES YOUR LOCAL RCA TUBE DISTRIBUTOR OFFERS YOU TODAY

1. Technical "Know how"

He started in Electronics on the ground floor . . . with *radio*. His advice and recommendations about circuits, tubes, and other electronic components are valuable to you.

2. Supply of Stocks

He's right around the corner; check with him first for items you need to fill on a rush priority basis.

3. Fast Delivery

If his normally adequate and varied stock should *not* include what you want, he's your one best bet today for locating it *fast!*

4. Intelligent Expediting

He's an old hand at tackling tough jobs. That's his business.
When you're in a jam, you'll find him well qualified to act as your expediting specialist.

Get to know this man. He's eager to help you. He's your EMERGENCY ELECTRONIC EXPEDITER! If you don't know where to find him, write us for the list showing your nearest RCA Tube & Equipment Distributor. RCA Victor Division, RADIO CORPORATION OF AMERICA, Camden, N. J.

TUNE IN "WHAT'S NEW?" RCA's great new show, Saturday nights, 7 to 8, E. W. T., Blue Network.

The Magic Brain of All Electronic Equipment is a Tube and the Fountain-Head of Modern Tube Development is RCA.

BUY WAR BONDS

RCA

RCA ELECTRON TUBES

ASK ABOUT...
RCA INDUSTRIAL MUSIC SERVICE

NEW BH FIBERGLAS SLEEVING

You've waited a long time for a sleeving that was *both* flexible and non-fraying. Now it's here—BH Extra Flexible Fiberglas Sleeving.

As an example of the hundreds of uses for this new product, let's look at a typical brush shunt job. Sleeving for this application should be flexible. When cut to length, the ends should not fray or spread. Formerly, brush manufacturers stiffened the ends of the sleeving to prevent fraying and also to facilitate threading onto the pigtail. BH Extra Flexible Fiberglas cuts cleanly without spreading, eliminates the extra dipping operation. Furthermore, in service the ends do not fray. Constant vibration produces only the slightest fuzz. Yet even these are but a few advantages of this new sleeving.

NON-FRAYING • FLEXIBLE • HEAT-RESISTANT
NON-INFLAMMABLE • WATER-RESISTANT
NON-CRYSTALLIZING at LOW TEMPERATURES

The new BH Extra Flexible Fiberglas Sleeving is woven from the choicest continuous-filament Fiberglas yarns. It possesses high dielectric strength, is water-resistant and, like all BH Sleeving and Tubing—is non-inflammable.

All sizes, from No. 20 to 5/8", inclusive, are available. Write for samples of this radically new and different sleeving today—in the sizes you desire. Seeing is believing! Bentley, Harris Manufacturing Co., Dept. W, Conshohocken, Pa.

BH PRODUCTS

NON-BURNING IMPREGNATED MAGNETO TUBING • NON-BURNING FLEXIBLE VARNISHED TUBING • SATURATED AND NON-SATURATED SLEEVING

BENTLEY, HARRIS MANUFACTURING CO.
Conshohocken, Penna.

...hey! string a line to my place!

Tomorrow's farm will be an electrified farm. It will hum with pumps, coolers, milking machines—not to mention the appliances "Ma" needs to run the house. Add to these the deep freeze units, intercommunication systems, and other new equipment of the future. And Farmer Brown will demand the kind of power he can get only from electric utility systems.

Rural Electrification after this war will demand thousand upon thousand of new electric meters—modern meters that will give accurate readings under a wide range of load conditions. When estimating tomorrow's meter needs, remember that modern Duncan Meters give you Lifetime Bearings, Alnico Magnets, Porcelain Bases, and Layer-on-Layer construction.

DUNCAN ELECTRIC MFG. CO.
Lafayette **Indiana**

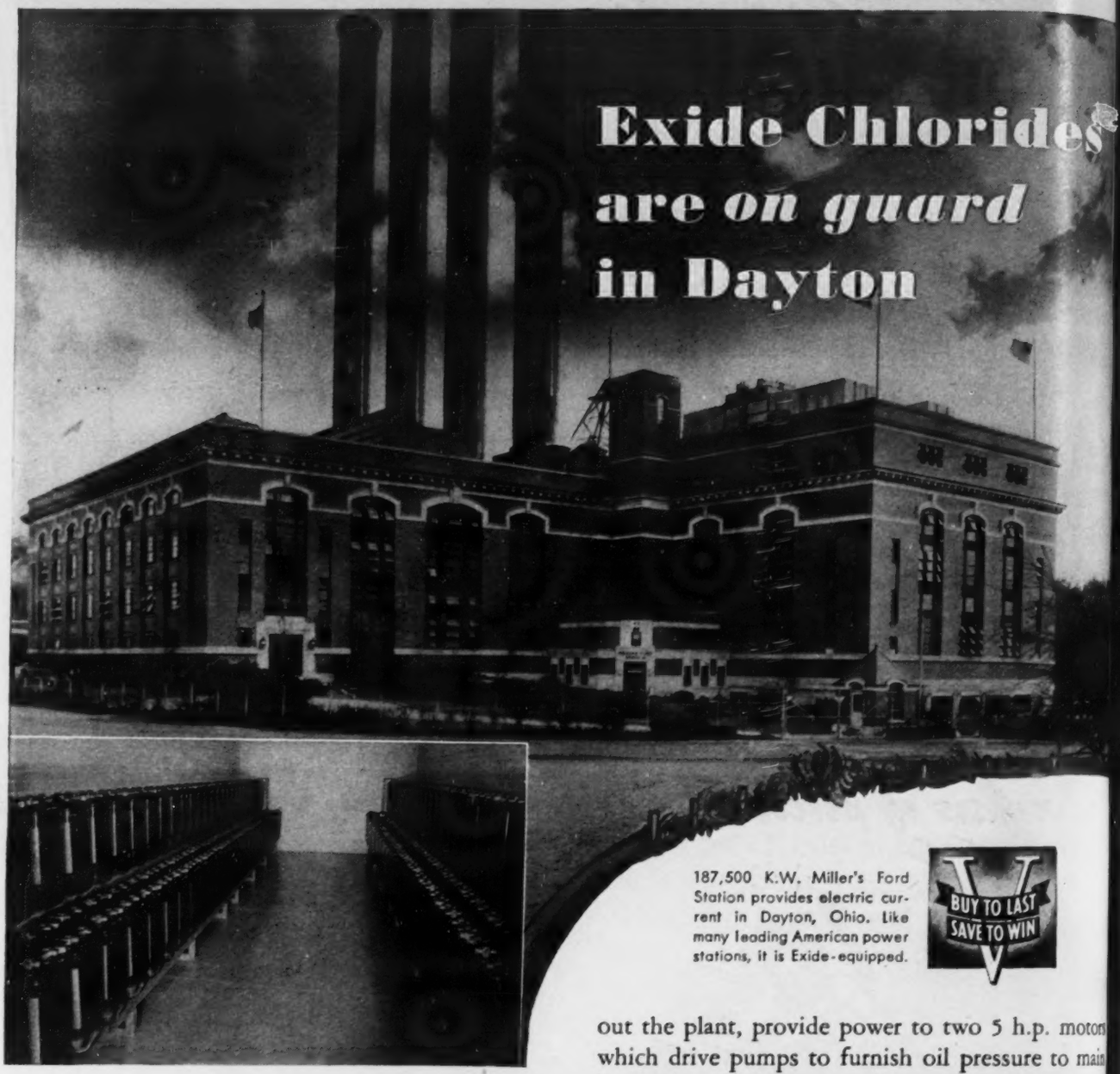
DUNCAN
WATTHOUR METERS

...makers of precision watthour meters for over forty years

ARMY E NAVY *Plant No. 1*

ARMY E NAVY *Plant No. 2*

Exide Chlorides are *on guard* in Dayton



187,500 K.W. Miller's Ford Station provides electric current in Dayton, Ohio. Like many leading American power stations, it is Exide-equipped.

BUY TO LAST
SAVE TO WIN

Dependable 120-cell Exide Chlorides are guardians at Miller's Ford. This is one of the two batteries used.

MODERN and efficient in every respect is Dayton's steam generating station located at Miller's Ford. Its operators, the Dayton Power and Light Company, have chosen Exide Chloride Batteries to guard its efficiency . . . and two great 120-cell units stand watch in the plant.

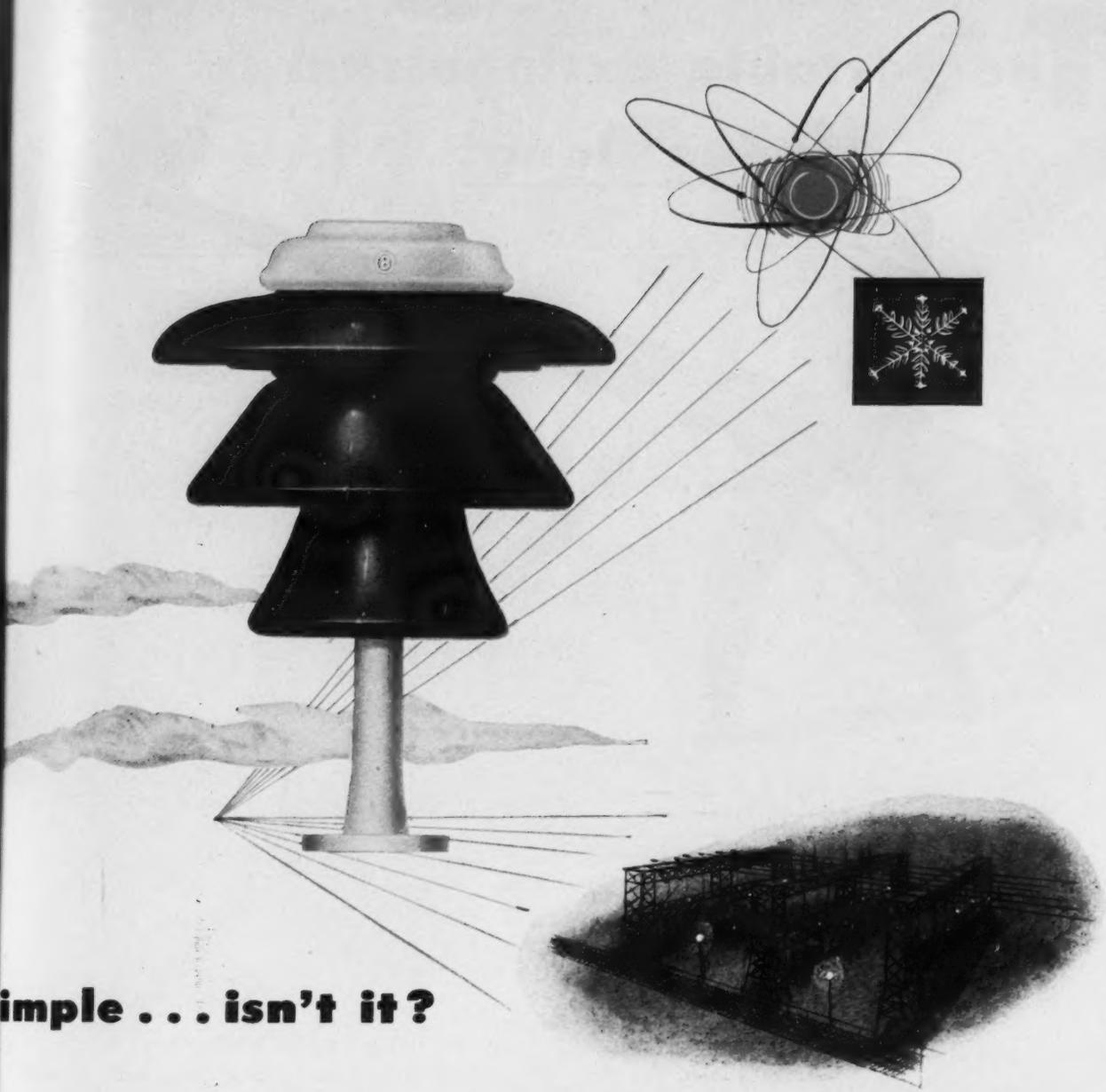
This pair of Exide Chlorides, each rating 500 ampere-hours capacity, provides a dependable power reservoir to operate the 75 oil circuit breakers which protect equipment. In addition, they assure adequate emergency lighting throughout the plant, provide power to two 5 h.p. motors which drive pumps to furnish oil pressure to main bearings and hydrogen seals of topping units . . . in case other power fails. Twenty-four ¼ h.p. pressure governor and rheostat-operating motors also get power from these Exides.

Dayton Power and Light Company, like similar utilities all over the nation, has had good reason to turn to Exides. The long-life, dependability, and assured ease of maintenance which characterize an Exide, are assurances of efficiency and low maintenance cost. When you buy an Exide, you *Buy to Last.* Take care of it and *Save to Win.*

ARMY E NAVY

Exide
CHLORIDE
BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • Exide Batteries of Canada, Limited, Toronto



imple . . . isn't it?

FOR good reason, station insulators of all reputable makes are completely standardized; are interchangeable on the same job. They must meet exacting specifications for dimensions and laboratory tests. With all these guideposts along the way, anybody can make a good station insulator. Simple--isn't it?

Standards apply to the behavior of a *new* insulator. No allowances are made for such questions as, "How long will these original characteristics remain unchanged?", or, "How long will the insulator endure extremes of temperature, changes of season, and conditions of service?". These factors are left entirely up to the integrity, experience, and skill of the insulator manufacturer. This isn't so simple!

For all their similarity of shape and uniformity of test results, when new, station insulators are no more alike than the people who make them. The people who make O-B's have been building fine insulators for some forty years, are the inventors of the suspension insulator, the all-porcelain bushing, and have made a host of other contributions to the art of insulation.

When you buy station insulators, you can't wait five or ten years to find out if your choice was sound, and even if you did, such information might be costly. You can be sure of being right ten or twenty years in the future by buying O-B station insulators today and depending on their sound "family background". Again, it's simple--isn't it?

2437-H

Ohio Brass

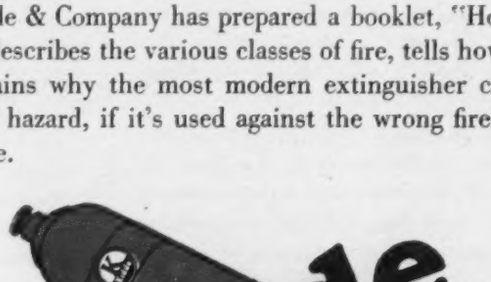
MANSFIELD, OHIO

CANADIAN OHIO BRASS COMPANY, LTD.,
NIAGARA FALLS, ONTARIO

The portable extinguisher 80 feet long!

No, not the container...that's a handy unit only 7 inches in diameter by 27½ inches high. But the carbon dioxide it contains, stored under high pressure, expands 450 times in volume when it's released. That's enough of the fire-smothering gas to fill a cylinder 80 feet long by 2 feet in diameter! And that's why this Kidde product is one of the fastest fire-fighters known.

Walter Kidde & Company has prepared a booklet, "How to Teach Fire Fighting." It describes the various classes of fire, tells how to fight each of them. It explains why the most modern extinguisher can actually be a dangerous fire hazard, if it's used against the wrong fire! Write for your copy—it's free.



WALTER KIDDE & COMPANY, INC., 1125 MAIN STREET, BELLEVILLE, N.

IN EVERY ELECTRICIANS' KIT Someday Soon...

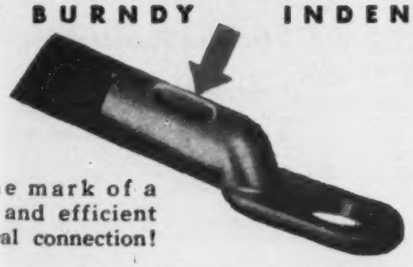
● A small wire connection can be made in several ways. But the simplest, surest way is with a Burndy HYDENT solderless connector.

That's why this Burndy HYTOOL (indenting pliers) will be standard in every electricians' kit . . . very soon. It will simplify and save time connecting up; and it will insure a trouble-free connection . . . stronger *mechanically* and *more efficient electrically* than by any other method!

Burndy HYDENT connectors are available for wire and cable sizes up to 2000 mcm . . . the larger sizes being installed with pneumatic or hydraulic HYTOOLS.

The new HYDENT Catalog gives complete information. Be sure to send for your copy to-day.

THE BURNDY INDENT

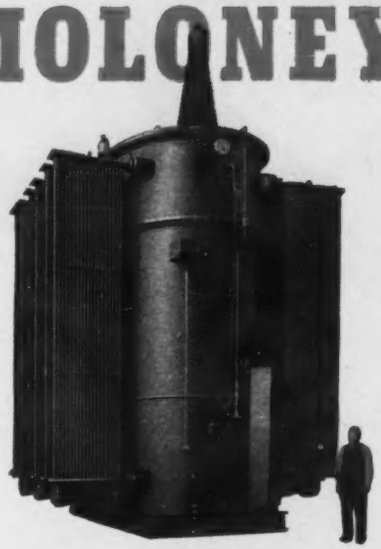


. . . the mark of a sound and efficient electrical connection!

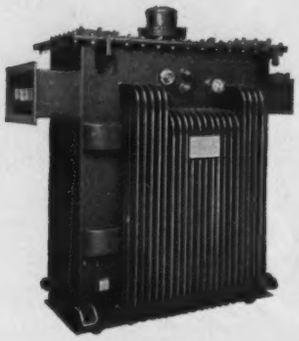
Burndy Headquarters for CONNECTORS

BURNDY ENGINEERING CO., INC.
107 EASTERN BOULEVARD, NEW YORK 54, N. Y.

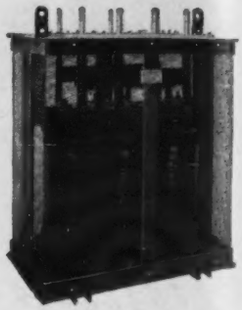
MOLONEY TRANSFORMERS



Moloney Power Transformer. Transformer pictured above is rated 25,000 Kva, 161,000Y to 13,200 volts. These transformers can be supplied in any capacity or voltage desired.



Moloney Askarel (non-inflammable liquid cooled) Transformer. For indoor installation at load centers without the use of fire-proof vaults. Available in all Kva and voltage ratings.



Moloney Air-Cooled Transformer with Class B insulation. For indoor installation at load centers without the use of fire-proof vaults. Available in voltages up to 13,800 volts and in capacities of 150 Kva and larger.

One of these MOLONEY transformers will meet your requirements . . .

Moloney manufactures transformers for all types of installations. If transformers of standard design do not fill your needs, our experienced engineering staff can design transformers which will exactly fit your requirements.

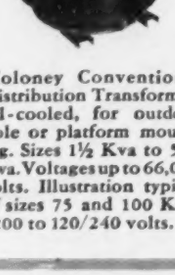
Disconnect switches, oil-fused cutouts, terminal boxes with potheads, forced-air-cooling, secondary air circuit breakers and many other features can be supplied on Moloney transformers.

Quick shipment can be effected whether the transformers are of standard or special design. Your inquiries will be given prompt attention.

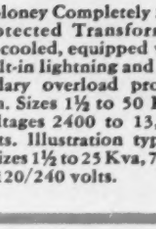
MOLONEY ELECTRIC COMPANY
ST. LOUIS, U. S. A.

Moloney Transformers for every purpose

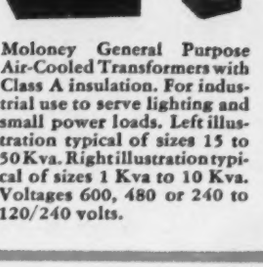
- Power Transformers
- Unit Substations
- Conventional Distribution Transformers
- Completely Self-Protected (CSP) Transformers
- Load Center Transformers
- Askarel (non-inflammable liquid) Cooled Transformers
- Air-cooled (Class A and Class B insulated) Transformers
- Constant Current Street Lighting Transformers
- Vault Type Transformers
- Submersible Type Transformers
- Furnace Transformers
- Shipboard Transformers
- Industrial Transformers
- Network Transformers



Moloney Conventional Distribution Transformer, oil-cooled, for outdoor pole or platform mounting. Sizes 1½ Kva to 500 Kva. Voltages up to 66,000 volts. Illustration typical of sizes 75 and 100 Kva, 7200 to 120/240 volts.



Moloney Completely Self-Protected Transformer, oil-cooled, equipped with built-in lightning and secondary overload protection. Sizes 1½ to 50 Kva. Voltages 2400 to 13,800 volts. Illustration typical of sizes 1½ to 25 Kva, 7200 to 120/240 volts.



Moloney General Purpose Air-Cooled Transformers with Class A insulation. For industrial use to serve lighting and small power loads. Left illustration typical of sizes 15 to 50 Kva. Right illustration typical of sizes 1 Kva to 10 Kva. Voltages 600, 480 or 240 to 120/240 volts.

Free Enterprise

THE OPPORTUNITY AND OBLIGATION TO COMPETE

☆

WE can be prosperous beyond our dreams—all of us—workers, farmers, and business men—but one f the prerequisites is the self-discipline of accepting ompetition for ourselves as well as others.

* * *

Free enterprise does not imply the freedom to use ny or all means to make a profit. It does not mean the ight to monopolize. ***It means the opportunity and bligation to compete.***

Competition requires ***independence of action, free ccess to the market,*** and ***no large degree of control ver the price*** by any buyer or seller. In general, the rger the number of sellers and the more easily buy- rs can shift from one seller to another, the higher ill be the degree of competition (and vice versa for uyers).

But let us not get too academic or go off the deep nd. We cannot have perfect competition. We cannot ubdivide businesses and labor unions into tiny units to ake a multitude of buyers and sellers in each market; e cannot reduce our rich variety of products to a few igidly standardized items; we cannot educate people o judge quality precisely; we cannot eliminate the costs f bridging space between buyers and sellers. On the ther hand, have we gone as far as is practical and esirable in these directions?

We cannot even have a system of highly "sensitive" rices, that is, prices which fluctuate immediately in esponse to every minor change in demand and supply. his would occur in the dream world of competition- -the-nth-degree. It cannot occur in the real world, even in the ideal world of competition best suited physical facts and human qualities. The economies f large-scale enterprise, the need for adapting products human wants, the costs of transportation and the sts of issuing and acquiring market information put ere limits on price sensitivity.

Economists tell us that if prices were extremely sen- tive, business booms and depressions would be much s severe—provided our stock of money remained irly constant. But with the somewhat limited degree sensitivity which is practicable in the economy, price d wage changes cannot prevent severe declines in business activity. ***We cannot count on competition alone to cure depressions.*** We must look mainly to other kinds of measures to prevent mass unemployment of men and machines.

If we cannot have prices which fluctuate with every small change in demand and supply conditions, we can work toward—and achieve, if we really want it—a system in which prices and wages are at least roughly responsive to long-run changes in demand and supply, a system in which most markets are not dominated by individual businesses, groups of businesses, labor unions, or farm organizations, and in which prices and wages are maintained at levels consistent with free access to markets and to jobs.

In any kind of an economic system there must be some means of determining prices, wages, and profits, and of bringing labor and capital into employment in the industry and place where they are most needed. There are two ways to do this: by administrative fiat or by the impersonal processes of the market. The first of these is typical of the totalitarian state; it frequently involves destruction of individual freedom or fumbling mismanagement. During the war all of us have had some experience with patronizing and paternalistic treatment by the state; we have found out what it means to be pushed around by bureaucrats; and we have discovered that the political determination of prices, wages, and profits leads to chaos when self-interest supersedes the fine fever of patriotism—as it eventually does. I do not mean to imply that we can do without controls over prices, production, and distribution in time of war; but I do suggest that we can learn something from their operation. Even with a united national purpose these controls work badly when human abilities are inadequate for the superhuman task, when personal or departmental jealousies crop up among officials, and when pressure groups try to prey on the rest of the public. Every day more Americans are beginning to understand why our forefathers feared the caprice and tyranny of power.

The impersonal processes of the market in determining prices and wages and in allocating productive resources will, in normal times, save us from the fumbling of bureaucrats and from the Babel of confusion, un-

certainty, and annoyance produced by their regulations. But these market processes will not save us from paying toll to those who monopolize and restrict entry to markets or jobs.

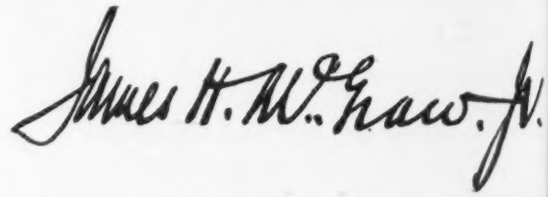
If we want an economy in which we are free to try out new ideas, develop new products, and introduce more efficient methods of production, if we want an economy in which there are great opportunities for men of imagination, inventiveness and energy, if we want an economy wide open to progress, then we must have a free field and fair competition for all comers—without collusion as to prices, markets, or production. This is the only basis on which we have a right to demand freedom from governmental regulation for ourselves and on which we can combat monopolistic tendencies in other quarters.

Let us stand squarely for the principles of the anti-trust laws and against all collusion and combination in restraint of trade. Let us insist that the government review with a critical eye every combination and consolidation which might restrict competition. Let us face frankly the problems of economic power arising out of price leadership and encourage every honest effort to find means to deal with them. Let us not shrink from questions as to whether some great aggregations of plants are too large for efficiency, free entry into the industry, and a free price. While we resist the efforts of the Department of Justice to extend the anti-trust laws by far-fetched and distorted interpretation, and while we fight every attempt to use them as a tool of persecution, let us cooperate in sincere efforts to modernize these laws and extend them by specific legislation to monopolistic practices they cannot now reach. I do not have a simple formula for this, but I believe we must try to find one.

We can then, better face the problem of the growing monopoly in labor which is threatening to make the free enterprise system unworkable. Today labor is going through a stage of empire building reminiscent in some ways of a similar stage in business three-quarters of a century ago. Witness the same buccaneering spirit, the same concentration on selfish interests, and the same disregard for the public welfare. Business leaders learned the hard way that the public will eventually rise up against those who prey upon them. Will our labor leaders be wiser? The right to collective bargaining to protect the weak position of the individual employee is one thing—but the grant of unlimited monopoly privilege to combine into a private government which can dictate its own terms to businesses, industries, communities, and even to the government itself, and which can start a wage-price spiral such as to hinder the war effort and make full prosperity impossible in time of peace is something quite different. We need to find a middle way which will prevent employers from exploiting employees but which does not sow the dragon's teeth. The exercise of arbitrary power by labor threatens not only business, but also all workers outside the unions and all those dependent on pensions and savings for their existence, and ultimately, of course, the well being of union workers themselves.

The idea that the labor problem can be solved if great, powerful organizations of employers will sit down with great, powerful organizations of labor is a delusion. If our experience in the N.R.A. and in the war teaches us anything, it is that the best that can be expected in the long run from such a situation is an armed truce with intermittent civil war. And every truce would be a monopolistic arrangement to take advantage of those not members of the great organized groups. Business and labor unions, whenever confronted with postwar readjustments that are unfavorable to them will be sorely tempted to protect their own special interests at the expense of the public. There will be efforts on the part of businesses, abetted by labor unions, to limit productive capacity, to raise tariffs, to obtain subsidies, and to maintain prices at artificially high levels. The unions will oppose labor saving changes and will seek higher wages even in areas and industries of surplus labor. Already demands are emerging for direct joint action by business, labor, and agriculture to solve the transition problems of special concern to them. While these groups should have every opportunity to register their own self-interest, we cannot entrust our fate to decisions made by pressure groups. If experience is any guide, such coalitions will be almost certain to restrict opportunities for progress and expansion, to exploit the public, and ultimately to injure even the businesses, workers, and farmers included in them. We cannot afford a postwar N.R.A. Resort to temporary government regulation in the transition from war to peace may, however, be necessary in cases of great hardship.

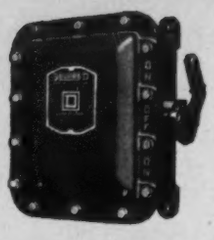
We can be prosperous beyond our dreams—all of us—workers, farmers, and business men—but one of the prerequisites is the self-discipline of accepting competition for ourselves as well as others.



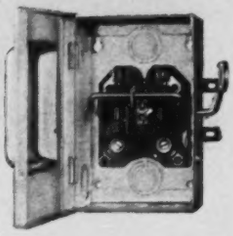
President, McGraw-Hill Publishing Company, Inc.

a Complete Line of safety switches

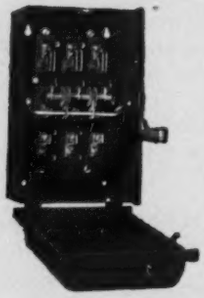
Weatherproof, dust-tight and explosion-resisting enclosures are available with ratings up to 200 amperes. Dust-tight switches approved for Class 11, Group G hazardous locations. Explosion-resisting enclosures approved for Class 1, Group D hazardous location.



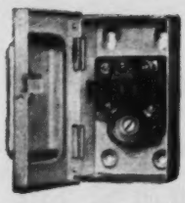
General Purpose Switches (Type D) are quick break only in capacities from 60 to 600 amperes inclusive. Thirty-ampere (and rain-tight) switches are not quick break. Made with 2, 3 and 4 pole and 2, 3, 4 and 5-wire s/n systems. 230 volt A.C. and 250 volt D.C.



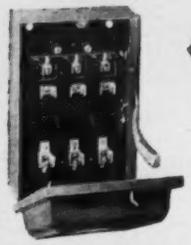
Type A Switches with visible blades. Quick make, quick break and interlocked cover; rated from 30 to 2400 amperes, up to 600 volts. Horsepower rated. Fusible and not fusible. 2, 3 and 4 poles and 3, 4 and 5-wire, solid neutral.



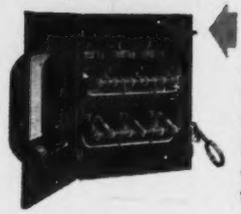
Blue Label Line—Type D Switches are compact, employing a rotary type of blade construction. Made for 2 pole and 2-wire and 3-wire, 230 volt A.C.-250 volt D.C. systems. Available for 30 to 60 ampere fusings. Front operated.



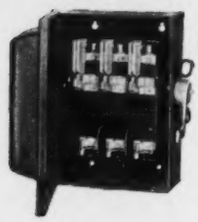
CALL IN A SQUARE D FIELD ENGINEER
If you have a problem which involves electrical control or distribution, you're welcome to the counsel of the nearest Square D Field Engineer. He is in constant contact with plants of every kind. He studies methods and applications with the idea of simplifying new jobs or doing old ones better.



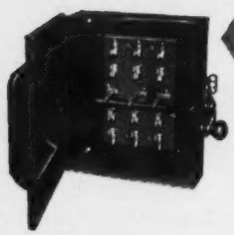
Type A Switches with concealed blades. Quick make, quick break and interlocked cover. Design permits smaller boxes with plenty of wiring space. Up to 200 amperes, 600 volts. H.P. rated. Made in 2 and 3 pole, 3 and 4-wire solid neutral.



Manual Motor Starters are available up to 60 amperes, 575 volts A.C. horsepower rated. Auxiliary blades shunt running fuses when operating handle is moved to starting position. Releasing handle automatically moves blades to running position with fuses in circuit.



Type C Industrial Safety Switches are quick make and quick break. Made up to and including 600 amp. 250 volts, 200 amp., 575 volts. Fusible and not fusible. Horsepower rated. 2, 3 and 4 poles, and 3, 4 and 5-wire solid neutral. Also available in rain-tight enclosures.



Double Throw Switches. Made in sheet steel or explosion-resisting enclosures, approved for Class 1, Group D hazardous locations. Interlocked covers and quick make and quick break mechanism in sheet steel enclosures.

SQUARE D's unusually complete line of safety switches covers five divisions: *1.* Heavy Duty Industrial Type A. *2.* Intermediate Industrial Duty Type C. *3.* General Purpose (Type D). *4.* Double Throw Switches. *5.* Manual Motor Starters.

The predominance of Square D switches throughout industry speaks volumes for their performance.

ELECTRICAL EQUIPMENT • KOLLSMAN AIRCRAFT INSTRUMENTS

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

Questions and Answers ON THE SUBJECT OF

CAPACITORS

FOR POWER-FACTOR IMPROVEMENT

CAPACITORS are one of the simplest pieces of electrical equipment. Yet, as simple as they are, they often present problems of application. The following questions are ones that have actually arisen in field work. We invite your specific questions on capacitors, and will be glad to run them in subsequent ads.

Question:
How is voltage drop reduced by capacitors?

Answer:
Lagging power-factor caused by motors, transformers and other inductive equipment normally causes a voltage drop equal to the product of the load current and line reactance. Capacitors, by improving the power-factor, will reduce the current and consequently since the voltage drop is a product of the reactance and the current, it too will be reduced. If the reactance of the capacitor chosen equals the inductive reactance of the line, the overall effect will be the same as though the line contained resistance only.

Question:
Do power-factor improvements consume any power?

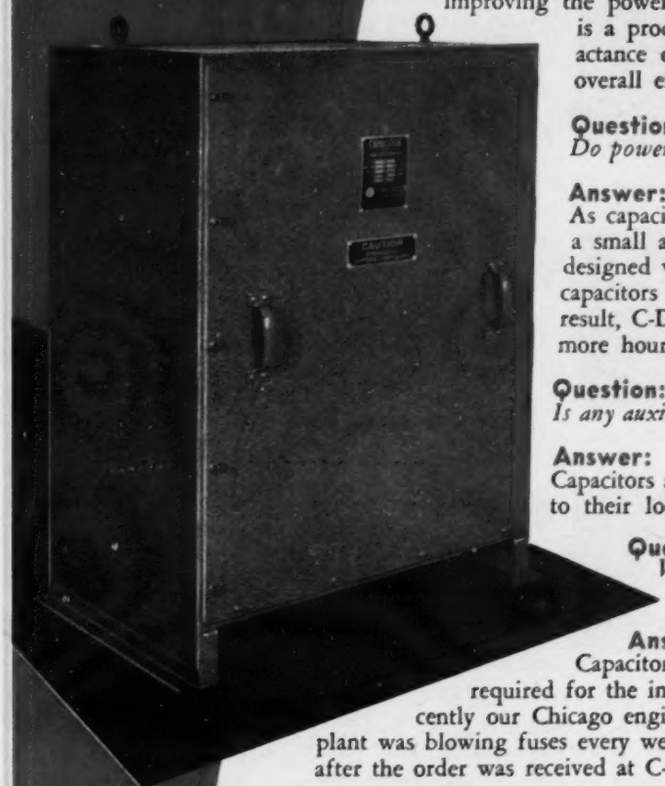
Answer:
As capacitors are the most efficient type of corrective equipment available, only a small amount is consumed, approximately 3 watts per KVA. C-D capacitors designed with the accumulative engineering experience gained in manufacturing capacitors exclusively for thirty-three years, have exceptionally low losses. As a result, C-D capacitors stand up better under all operating conditions and assure more hours of trouble-free operation per dollar invested.

Question:
Is any auxiliary equipment necessary with power-factor capacitors?

Answer:
Capacitors are shipped complete ready for installation and require only wiring to their location.

Question:
What about the time needed for installing power-factor capacitors?

Answer:
Capacitors can be installed and put into operation at a fraction of the time required for the installation of other types of corrective equipment. Typically, recently our Chicago engineer called us on the phone. Poor power-factor in a big war plant was blowing fuses every week—tying up important production schedules. Forty-eight hours after the order was received at C-D, capacitors were in service in the Chicago factory.



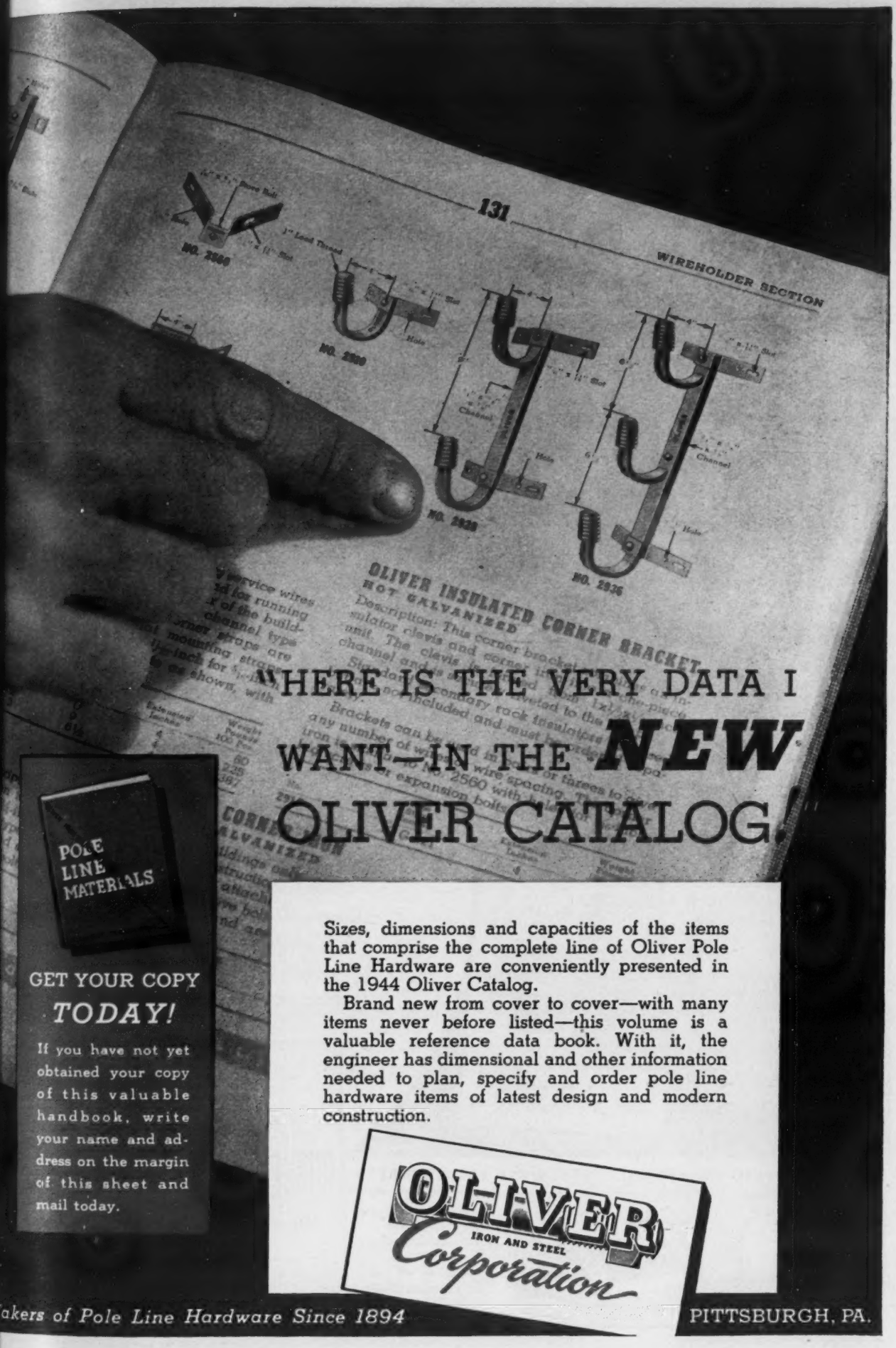
INDOOR DUST-TIGHT CAPACITOR
[illegible] KVA · 440 VOLTS
3 PH., 60 CYCLE

Question:
Does Cornell-Dubilier handle any large installations?

Answer:
Some of the largest installations for power-factor improvement are C-D capacitors. And conversely, many of the smaller capacitor installations are also C-D's. A C-D engineer will be glad to give you all the information you want. Cornell-Dubilier Electric Corp., So. Plainfield, N. J.

Cornell Dubilier
capacitors
MICA • DYKANOL • PAPER
WET AND DRY ELECTROLYTICS

THE WORLD'S LARGEST AND OLDEST
MANUFACTURER OF CAPACITORS—1910-1943


131
WIREHOLDER SECTION
NO. 2560
NO. 2929
NO. 2936
OLIVER INSULATED CORNER BRACKET
HOT GALVANIZED
"HERE IS THE VERY DATA I WANT—IN THE NEW OLIVER CATALOG!
POLE LINE MATERIALS
GET YOUR COPY TODAY!
If you have not yet obtained your copy of this valuable handbook, write your name and address on the margin of this sheet and mail today.
Sizes, dimensions and capacities of the items that comprise the complete line of Oliver Pole Line Hardware are conveniently presented in the 1944 Oliver Catalog.
Brand new from cover to cover—with many items never before listed—this volume is a valuable reference data book. With it, the engineer has dimensional and other information needed to plan, specify and order pole line hardware items of latest design and modern construction.
OLIVER IRON AND STEEL Corporation
Makers of Pole Line Hardware Since 1894
PITTSBURGH, PA.

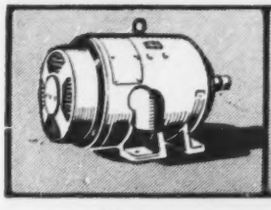
What can BURKE do for Me?

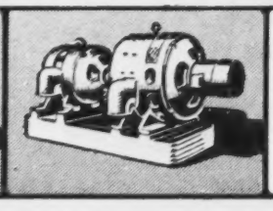
HERE'S a quick look at Burke Products to answer the headline question. When you examine each booklet, more specific questions will develop, questions that Burke engineers will be glad to answer.

You may be surprised to learn that Burke pioneered and perfected the Universal Motor and the 3-Wire D. C. Generator, that Burke introduced the high cycle Motor Generator Set for powering High-speed Tools, and that Burke was first to use electric welding construction. In order to have you know Burke better we will be glad to send you a complete set of these Burke Bulletins.

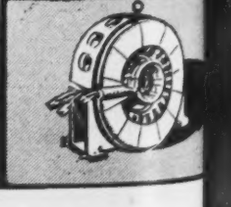
For quick reference to the Burke line, see Sweet's Catalog File and Electrical Buyers' Reference Catalog.

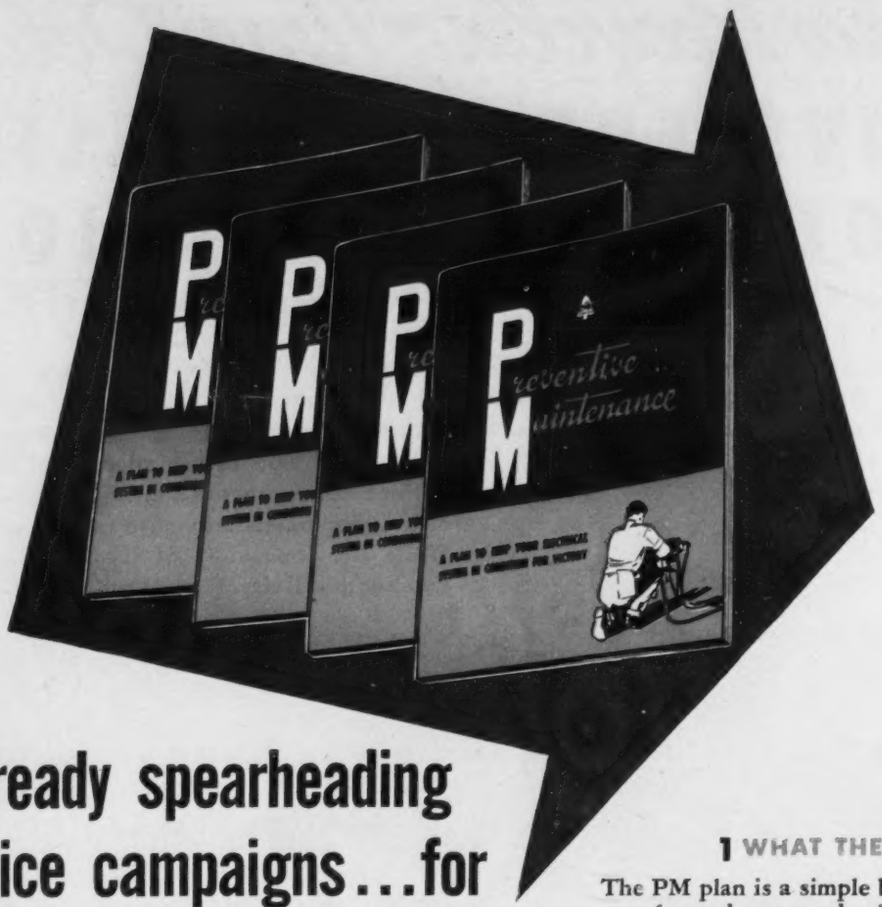
BURKE ELECTRIC COMPANY • 1205 WEST 12TH STREET ERIE, PENNSYLVANIA





D.C. Equipment to 1500 H.P. and 1000 K.W.
A.C. Equipment to 1500 H.P and 1000 K.W.
M-G Sets to 1000 K.W.
Molded Bakelite Terminal Blocks





Already spearheading service campaigns...for more than 60 Utilities

THE PM PLAN

Introduced a short time ago, Anaconda's Preventive Maintenance Plan is being widely used by utilities to help customers keep electrical systems operating *efficiently*—despite shortages in essential wiring equipment.

Already some 60 utilities are actively engaged in this program. With it, they are helping their industrial power customers maintain continuous wartime production by preventing electrical breakdowns.

1 WHAT THE PLAN IS

The PM plan is a simple but comprehensive way to safeguard war production by preventing electrical breakdowns *before they develop.*

2 HOW IT WORKS

The plan provides a practical means of making periodic, systematic analysis of circuits and equipment. Uncovers potential weaknesses . . . suggests ways to correct them . . . prevents overloading of lines.

Data thus gathered aids local W.P.B. Branches in reaching decisions on requests for materials to *prevent* breakdowns.

3 HOW UTILITIES BENEFIT

The PM plan helps utilities maintain close customer contact despite a lack of "something to sell." Offers basis for service campaign that definitely appeals to customers. Puts the utility in a leadership role for furthering war production throughout the area it serves.

If you aren't already utilizing the Anaconda Preventive Maintenance Plan, mail the coupon for full details. 43234

"Tomorrow may be too late . . . do it today!"

ANACONDA'S PREVENTIVE MAINTENANCE PLAN

Anaconda Wire & Cable Company
25 Broadway, New York City 4

Please send copy of the Anaconda Preventive Maintenance Plan for safeguarding wartime production.

Individual .....

Company .....

Address ..... City .....

11L

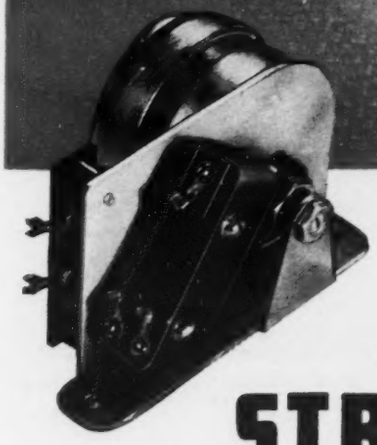
Dunco Recycling Time-Delay

RELAYS FOR CONTROLLING AUTOMATIC OPERATIONS

THERMAL • INERTIA • MAGNETIC • MOTOR-DRIVEN

New developments in Struthers-Dunn motor-driven Type PS Recycling Time-Delay Relays have resulted in units ⅓ the size of previous compact timers, and having 100% ball-bearing clutch and cam members.

Other Dunco Time-Delay Relays of inertia, thermal, or magnetic construction afford a complete assortment for modern engineering requirements. Based on broad, specialized experience in this field, Struthers-Dunn engineers will gladly make recommendations to meet your needs. Write for your copy of the complete Dunco Catalog and Relay-Timer Data Book.



◀ SMALLER — CONTINUOUSLY ADJUSTABLE

Another important Dunco Timer development is the Type PSY1 shown at left. Exceptionally compact, its contact closure time is continuously adjustable from 0 to 100% of the cycle time. It operates continuously at 1 cycle per minute.

STRUTHERS-DUNN, Inc.

1321 ARCH STREET, PHILADELPHIA, PA.

DISTRICT ENGINEERING OFFICES: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DENVER • DETROIT • HARTFO
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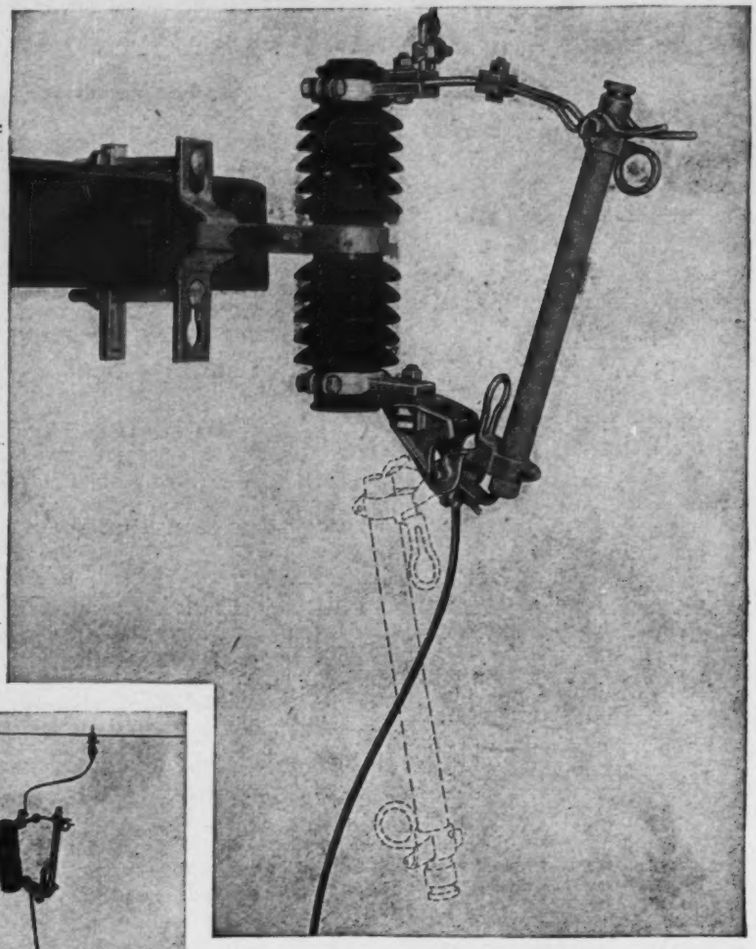
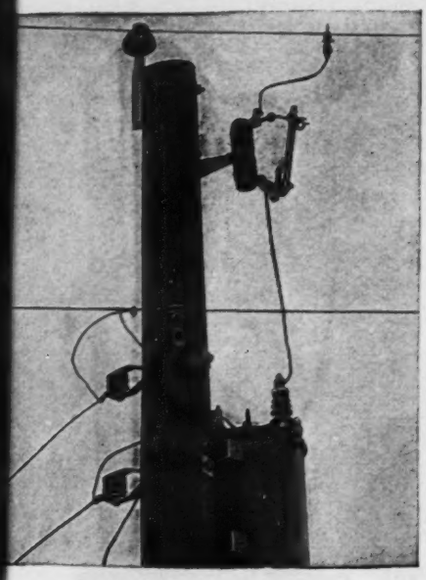
LOWEST TENSION DROPOUT
MATTHEWS FUSWITCHES

Rugged

Nothing Flimsy About Them



Low Tension Prevents Fuse Link Breakage



Mounted on pole by means of through bolt or lag screws.

Single Insulator Style in three sizes: 5, 7½/12½ and 15 KV, all rated 100 Amperes.

Also made in four sizes with two insulators.

Catalog 1452-4 on Crossarm.

Where your war efforts require Open Type Dropout Cutouts, these single insulator Matthews Fuswitches are available for prompt shipment on proper preference rated orders.

The quick, unfailing clearance of faults; the sturdy design and construction with strong highest quality materials; the simplicity and ease of operation, and many other superior features assure you of the lowest possible TIME COST.

Bulletin 102 illustrates and describes the efficiency and money saving possibilities of these single insulator Matthews Fuswitches and their companion 2-insulator types, as well as all other Open Type Matthews Fuswitches. A copy will be sent promptly on request.

W. N. MATTHEWS CORPORATION

Engineers and Manufacturers Since 1899

ST. LOUIS, U. S. A.

"So men may li

Crash landings at sea used to mean "curtains." Now, more and more of our fliers come back . . . thanks to modern life rafts. Today's improved *"See-ability"* is helping workmen build them faster — and better . . .

Let's suppose you're flying a patrol and run out of gas far at sea. Your engine sputters, dies and—down you come.

A tough spot . . . but almost before your ship hits the water you're clear and aboard the rubber raft stowed away for just such emergencies.

Rugged, sea-worthy, these amazing boats have kept fliers and their crews afloat for weeks! No wonder they can take it—when you realize how carefully they are built; how rigidly materials and workmanship are tested and re-tested!

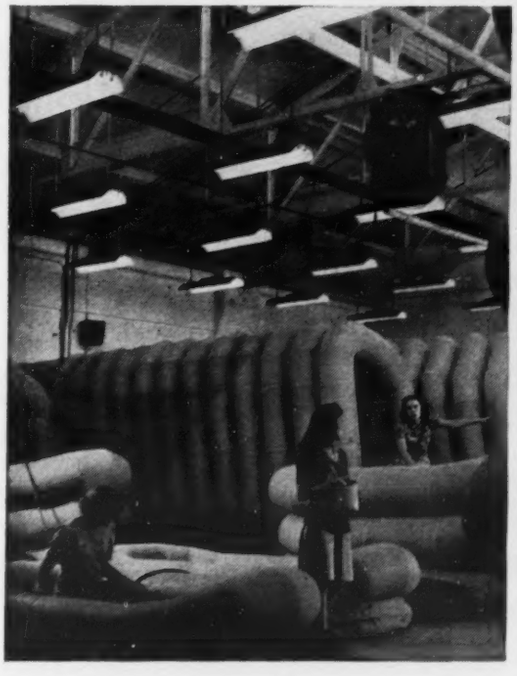
On this life-and-death job "See-ability" through modern improved lighting is playing an important role. It is helping eyes and fingers do their work faster, more efficiently. It is speeding production—reduci "rejects," increasing quality.

In fact, in this as well as other vital war work, millio of Westinghouse Mazda Lamps are bringing bet "See-ability," helping set new peacetime lighti standards for the industrial world of tomorrow.

Recommend Westinghouse Mazda Lamps to yo customers who are on war work. Today's lamps a brighter, longer-lasting, lower-cost than ever befor Westinghouse Electric and Manufacturing Compan Bloomfield, N. J. *Plants in 25 cities...offices everywhe*

Easy on the eyes (*opposite page*) . . . Looking for broken thre in boat fabric. Here the operator must look directly into t light. How significant that Westinghouse Mazda Fluoresc Lamps were chosen for this critical task!

KEEP YOUR DOLLARS FIGHTING . . . BUY WAR BONDS



live to fight again!"

Westinghouse

MAZDA LAMPS

FOR BETTER "SEE-ABILITY"

This
NEWSPAPER
advertisement was published in Washington, New York and Chicago by McGraw-Hill, to make friends for business.

Have you ever been out of a job?

What you can do

The best way to insure good jobs and better living is to create an environment favorable to continuous industrial progress.

The best way to insure healthy industrial progress is through a nation-wide understanding of the fact that we live better through doing more work in less time.

Nation-wide understanding of that fact will result in laws that encourage industrial progress.

Nation-wide understanding always will be a will-o-the-wisp, unless each business man does his share of: (1) Understanding his own responsibilities in maintaining industrial progress; (2) Explaining the relation between *good* business and good living to his employees and neighbors.

The newspaper advertisement reprinted here is McGraw-Hill's share in the job of explaining the source of good living. It has appeared in Washington, New York and Chicago, as well as in all McGraw-Hill publications. It is available, for use over your own company signature, in your plant city. A mat, six-column size for newspaper reproduction, will be sent to you upon request. Booklet reprints are also supplied at cost ($10.00 per thousand).

James H. McGraw, Jr.
President

McGraw-Hill Publishing Company, Inc.

IF you have ever been out of a job, and if you had a wife, children and slender resources at the time, then the fattest paycheck will never quite obscure the memory of the days and nights you lived with fear.

Some of that fear lingers in every man's mind, for all have suffered in some degree.

► That's why you hear the words "postwar planning" so often. Americans are determined that, one way or another, they are going to keep our thousands of factories going after the war, so that there will never again be a vast army of unemployed.

As usual, in a democracy, there are two entirely different ideas as to how to make 56 million jobs grow after the war, where only 46 million existed before.

Both kinds of people, who hold these different ideas, sincerely want to make the postwar world a better place for you to live in. They have complicated arguments, backed by lots of figures.

But when you trim all the arguments and figures down, you find that one side believes in DIVIDING jobs to make them go round, and the other side believes in MULTIPLYING jobs so there will be greater opportunity for all.

We believe in the MULTIPLYING plan for making postwar jobs and ask you to believe in it too.

Look back over our history. What made us great? Was it rich soil? Africa's is as rich. Was it

FREE MATS: If you would like to publish this message over your own company name, or distribute it in handy booklet form, write or wire: Research Dept., McGraw-Hill Publishing Co., Inc., 330 West 42nd St., New York (18), N.Y.

ave you ever been out of a job? (cont'd)

ral resources? China has them in abundance.

NO, the greatness and the good living of erica is the direct product of her genius for g more work in less time.

Invention is the source of improvement, and *rovement* is the multiplier of jobs . . . when lucts are improved in service or style, or low- in price, new customers are attracted and jobs created.

That's why it is true that good living has its ce in industrial progress.

When industrial progress is interrupted, we a depression, and there is less good living.

When (through courageous investment in new better products) industrial progress is resumed, go on to even higher levels of good living.

If every able-bodied person in America is to a job, then we must all understand the things make good living possible, and we must all *improve* the methods that have given so much l living to so many people already.

For businessmen, that means a constant search improved methods and machines, a regular -after-year investment in industrial progress. means avoidance of such things as specula- in inventories that tend to create booms and ressions rather than consistent progress.

For every citizen, it means a constant search the best ways and means to prevent and cure ressions.

Businessmen, alone, cannot prevent bad times. a job for *every* citizen. Every American can just by knowing that good living comes from g more work in less time. If you, and all other ericans, swing on to that fact, the laws that rol our rate of industrial progress will be r designed to keep the improvement engine ing.

That's where government really can be helpful ostwar planning.

It can encourage the "take a chance" spirit is the basis of all progress. And it can improve measures which prevent and cure depression.

At present, our laws are not framed to encourage investment in new and better methods.

Many local, state and national taxes work out in favor of keeping an old machine, instead of buying a new one.

► There are tens of thousands of machines in the country that are over 20 years old. Even our shiny new war equipment is living 3 years in one, and will be old when the war is over.

Every machine should be regarded as obsolete as soon as it is installed and work started on a better one. In the long run, that is the best way to multiply jobs and create better living. Our laws should *encourage* the process, not *discourage* it.

New machines can only be bought with the profits created by old machines. The money that is laid aside by industry to develop and buy new machines is called "Seed Money." If laws take away too much of the Seed Money of business, that will prove disastrous. High taxes must be paid, but they should not destroy Seed Money, which is the only source of improvement.

That's why it's so important for everyone, no matter what his walk in life, to know this fundamental fact:

"Industrial Progress
is the Source of all Good Living."

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION

24 publications, which gather "war-news" from the "war-production-front" through a staff of more than 153 editors and 725 engineer-correspondents . . . More than 1,500,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

McGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

This advertisement is available in handy booklet form. (Less than 100 copies free. Larger quantities, $1.00 per 100; $10.00 per 1000.)

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PUBLISHING COMPANY, INC. : : : BOOK COMPANY, INC.

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THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION:

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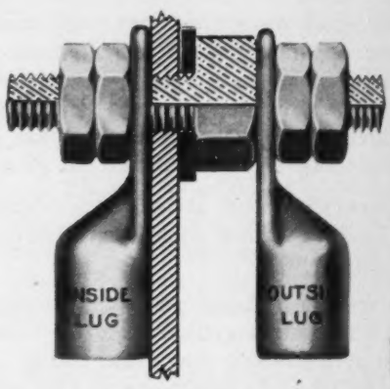
Publishers International Corporation, an affiliate, publishers of Business and Technical Magazines for Latin America, and Overseas Circulation

Save material, Save space . .

USE STANDARD 3 CONDUCTOR G&W POTHEADS

ON YOUR 4 CONDUCTOR GROUNDED NEUTRAL CABLES

It's simple as can be: if the fourth wire of your four-conductor cable is a grounded neutral, use a G & W three-conductor pothead with a neutral stud and lugs in the body —instead of a four conductor pothead. It serves perfectly, takes less space, saves appreciable material—and costs less. Entrance fittings for the base are readily available in standard interchangeable parts, for either four-conductor or four single-conductor cables.



This fact is important to remember: practically any G & W Pothead body can be fitted with a grounding stud, in front or at either side. The gasketed hex portion of the stud is an effective seal against moisture getting in, and compound or cable oil getting out. The extra cost is negligible.

Select the correct 3 conductor pothead in Bulletin 392. Add symbols "GL" to designate that pothead should be equipped with neutral ground stud and lugs. Specify conductor size. State preferred location of the stud in the body. If you haven't Bulletin 392, better write for a copy right away.

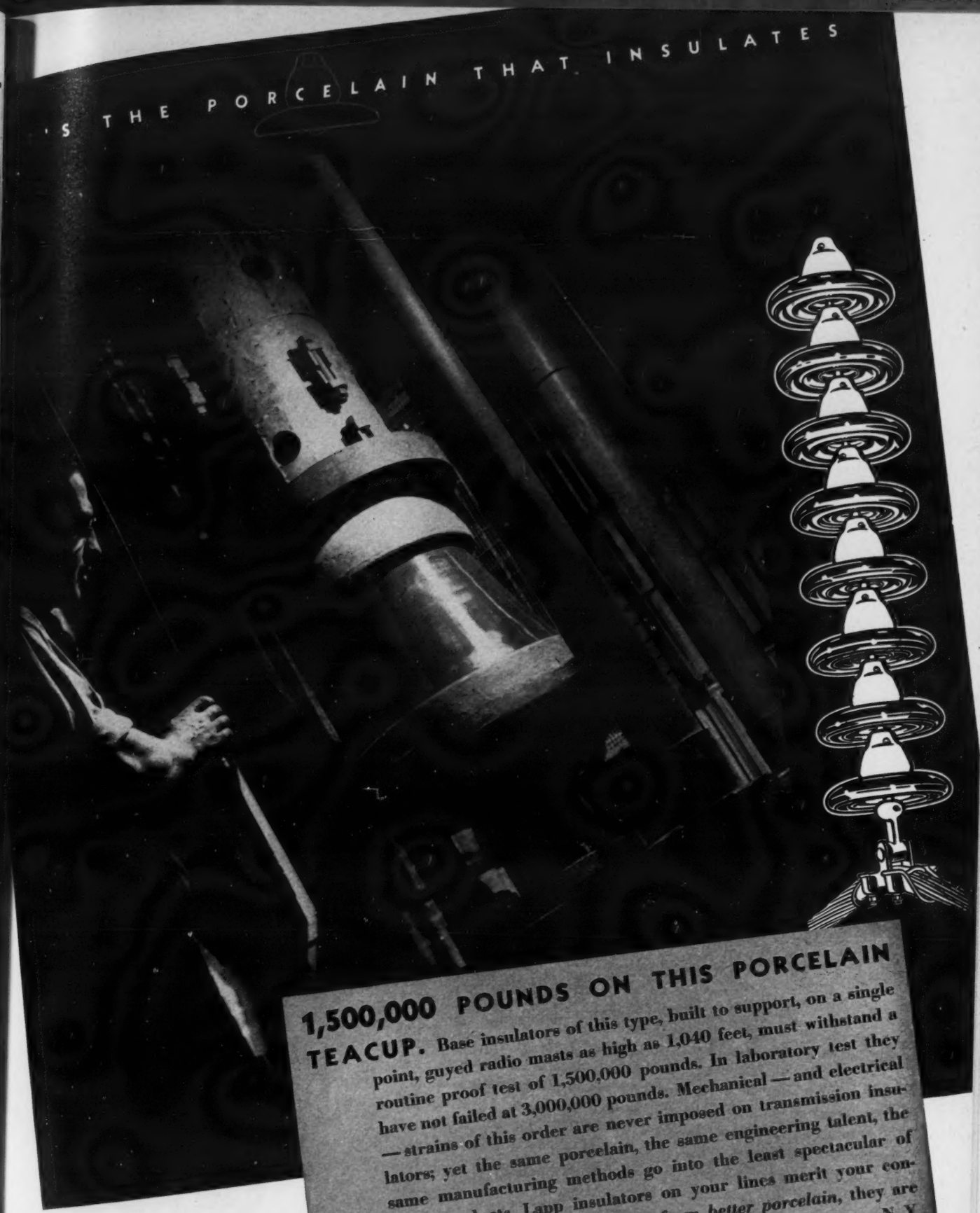
G&W ELECTRIC CABLE DEVICES

G & W ELECTRIC SPECIALTY CO.

7780 DANTE AVENUE • CHICAGO, ILLINOIS

In Canada—Powerlite Devices, Ltd., Toronto, Ont.

POTHEADS . . . BOXES . . . OIL FUSE CUTOUTS . . . OIL SWITCHES AND MULTIPLE CIRCUIT OIL DISCONNEC



1,500,000 POUNDS ON THIS PORCELAIN TEACUP.

Base insulators of this type, built to support, on a single point, guyed radio masts as high as 1,040 feet, must withstand a routine proof test of 1,500,000 pounds. In laboratory test they have not failed at 3,000,000 pounds. Mechanical — and electrical — strains of this order are never imposed on transmission insulators; yet the same porcelain, the same engineering talent, the same manufacturing methods go into the least spectacular of Lapp products. Lapp insulators on your lines merit your confidence. Because they are made from *better porcelain*, they are *better insulators.*

Lapp Insulator Co., Inc., LeRoy, N. Y.

Lapp

ARMY E NAVY

Better Porcelain • Better Insulators

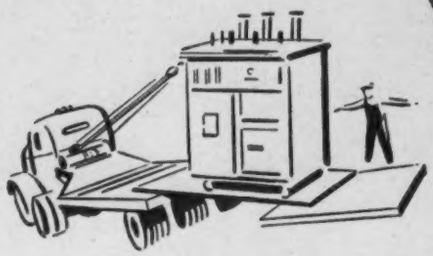
EQUIPMENT COST

2000 Kv-a., 13,800/4160 Volt
OPEN-TYPE SUBSTATION

3—Single-Phase Power Transformers
1—Three-Phase Regulator
Metering, auxiliary transformers and switching equipment
Protective devices
Numerous other miscellaneous items

Steel structure

$15,062



2000 Kv-a., 13,800/4160 Volt
CSP TRANSFORMER

Everything complete in one unit

No overhead structure required

$14,458

TOTAL COST

Saving in cost...at least $604.00 plus

PLUS
Extra cost for added ground space required

PLUS
Time required to erect structure and assemble many separate items

IN DOLLARS AND CENTS, TOO

...it pays to pick easy-to-order... easy to install... easy to move...

CSP's

A CSP Power Transformer performs all the functions of a conventional single-circuit substation ... better ... at less cost. For a given capacity and voltage rating, it will save up to 6% PLUS a substantial reduction in installation expense. Contractors have estimated this last saving as high as $1500.00.

CSP Light-duty Power Transformers meet the problems of present war conditions: they require less space, less man power and less critical materials to install. And if, or when, a load center shifts as many probably will after the war ... the CSP Transformer can be shifted easily with it ... 100% salvage.

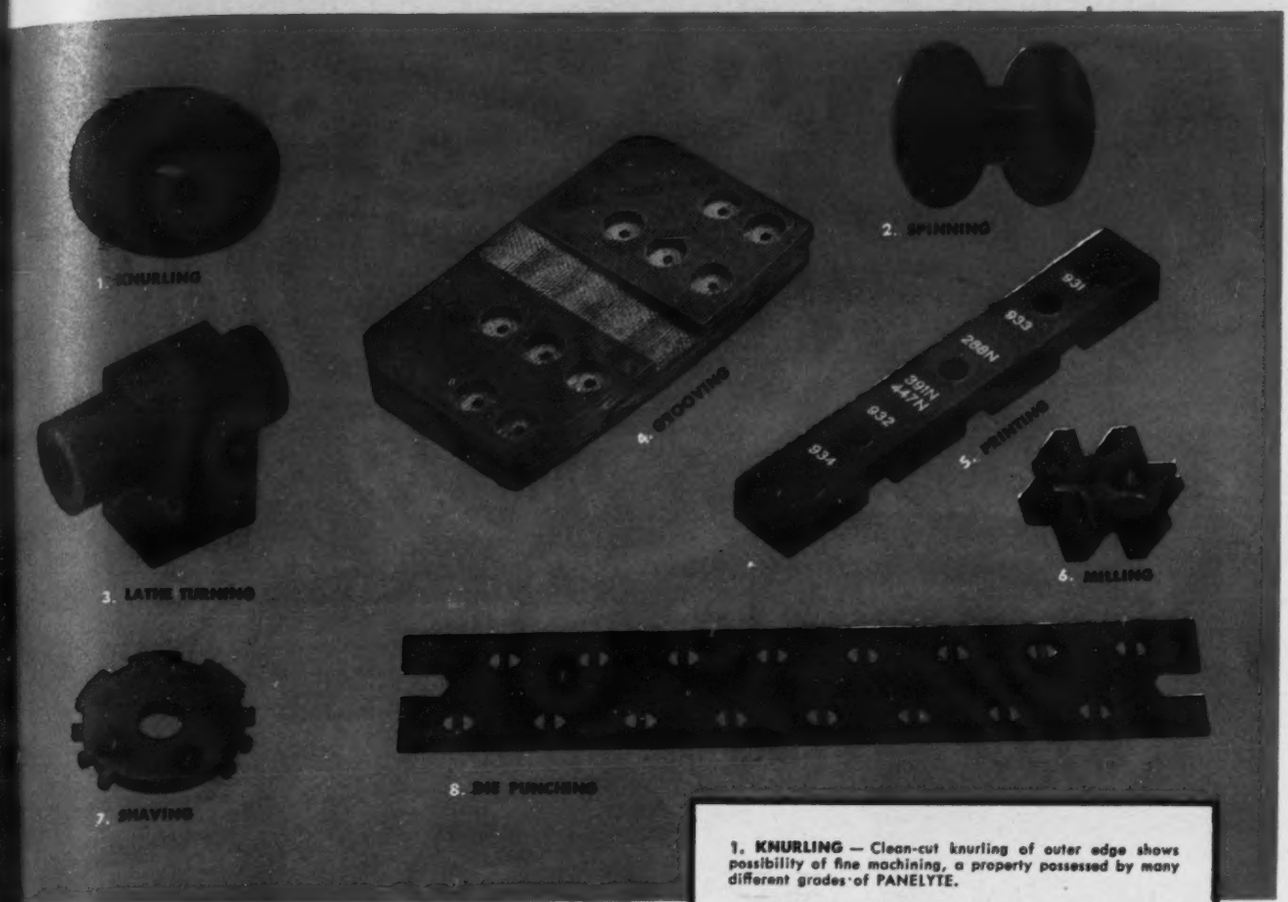
Get full information on CSP Transformers to meet your requirements. See your Westinghouse representative or write Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

J-70420

Westinghouse

PLANTS IN 25 CITIES ... OFFICES EVERYWH

POWER CASE PRMEI



The Versatility of Panelyte*

e Structural Plastic, and its adaptability to the unusual or difficult" application is evident in the random selection of parts own above. If sheets were not thoroughly bonded and the ructure homogeneous, fine cutting and close tolerance work ould be impossible. PANELYTE is manufactured in Sheets, ds, Tubes, Molded Forms and Fabricated Parts; paper, fabric, ass fibre, and asbestos base types.

Our Engineering Staff will work with you on any problem olving the use of structural laminated resinous plastics.

1. KNURLING — Clean-cut knurling of outer edge shows possibility of fine machining, a property possessed by many different grades of PANELYTE.

2. SPINNING — Shoulder of this part turned on tube. Washers punched and then spun or swedged to core.

3. LATHE TURNING — Irregularity of shape is no obstacle with PANELYTE. Parts are lathe turned to exact specifications.

4. GROOVING — Groove at taper on top surface milled, as is 1/16" groove in center of part. End milling for corners and curved contour on face.

5. PRINTING — Milled or drilled terminal block demonstrates clarity of identifying figures and letters printed or engraved on PANELYTE.

6. MILLING — Flat bed milling and drilling assure exceptionally close tolerances in this precision part of intricate design.

7. SHAVING — For greater accuracy than that required in standard punched parts, PANELYTE die parts are shaved to obtain essential smooth edges.

8. DIE PUNCHING — Straight die punching is used in the rapid, economical production of countless PANELYTE electrical parts.

NELYTE DIVISION, ST. REGIS PAPER COMPANY...AMERICA'S LARGEST PRE-PEARL HARBOR PRODUCER OF THERMO-SETTING MOLDED LAMINATED PLASTICS

PANELYTE *the structural plastic*

PANELYTE DIVISION
ST. REGIS PAPER COMPANY
230 PARK AVENUE
NEW YORK 17, N. Y.

SS PRODUCTION OF SHEETS, RODS, TUBES, MOLDED FORMS, FABRICATED PARTS

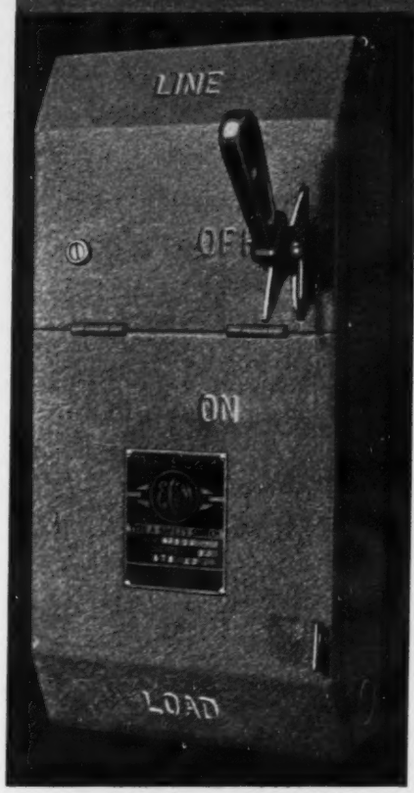
ices: Atlanta, Chicago, Dallas, Denver, Detroit, Houston, Kansas City, Los Angeles, Montreal, New Orleans, St. Louis, St. Paul, San Francisco, Seattle, Toronto, Vancouver

erienced and reliable Fabricators in Industrial Centers from coast-to-coast

HEAVY DUTY CONSTRUCTION

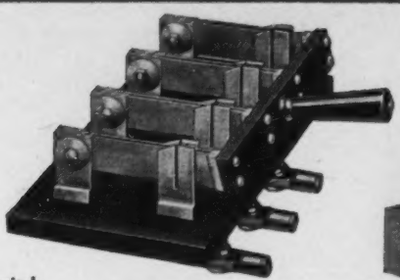
Safety Switches
FOR PLANT and OFFICE

Knife Switches
(OPEN STYLE)

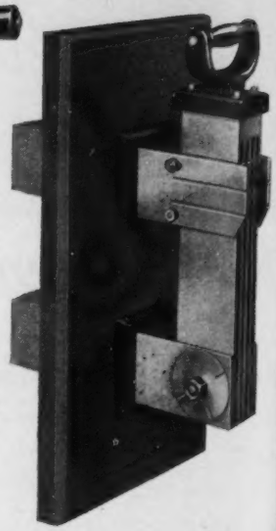


★ Type "A" Safety Switch, 60 amp., 3 pole, 230 volt fusible switch; only 9½" wide, 17½" long, 4¼" deep.

THIS switch is of heavier design than the average, with all steel parts, extra heavy gauge, plated to be corrosion-resistant and all actuating parts case hardened. Extremely compact . . . small and narrow with no projections beyond width of box, it permits mounting where space is limited. With a (baked) finish both attractive and durable, the switch "fits" into office as well as plant locations . . . wherever good appearance and long service are important. Ask for Bulletin 1300.



★ 200 amp., 4 pole, single throw, back connected, non-fusible knife switch.

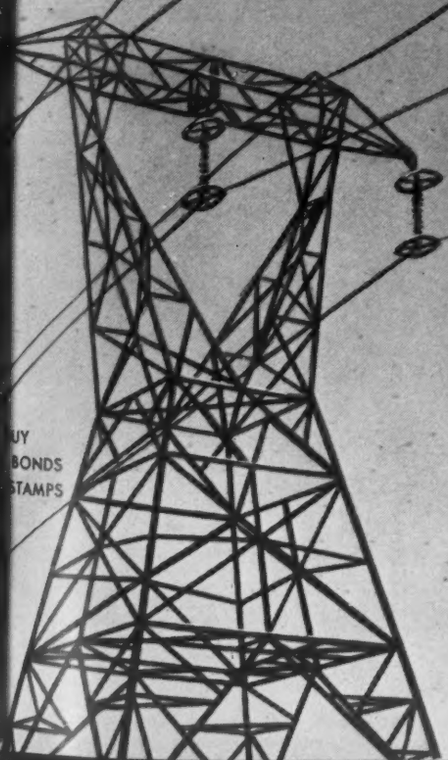


★ 5000 amp. d.c. single pole, laminated stud knife switch.

LIKE the Safety Switch, this Type "A" Knife Switch is of heavy duty construction . . . jaws set into base blocks, securely riveted and sweated into place, all current carrying parts of electrolytic copper. Hinges and receptacles are of rugged construction. Another feature is the exceptionally generous contact area with laminated poles maintained under high pressure due to the clamping effect of multiple construction. Ask for Bulletin 1320.

THE ELECTRIC CONTROLLER & MFG. CO.
2700 East 79th Street ★ Cleveland 4, Ohio

LIFE LINE OF WAR PRODUCTION



Through transmission lines flows the current that makes American war production possible. Supporting these Arteries of Victory are Blaw-Knox Transmission Towers . . . proved by their performance to be engineered right, built right for long-lasting, low-maintenance service.

BUY BONDS STAMPS

BLAW-KNOX
TRANSMISSION TOWERS

Blaw-Knox Division of Blaw-Knox Company
Farmers Bank Building, Pittsburgh, Pa.
New York • Chicago • Philadelphia • Birmingham • Washington

UNDERWRITERS' LABORATORIES, INC. INSPECTED
RIGID STEEL CONDUIT
60

NATIONAL ELECTRIC PRODUCTS CORP.
SPELLERIZED
SHERARDUCT
SCALE-FREE
PITTSBURGH, PENNA.

To Keep away from Rust

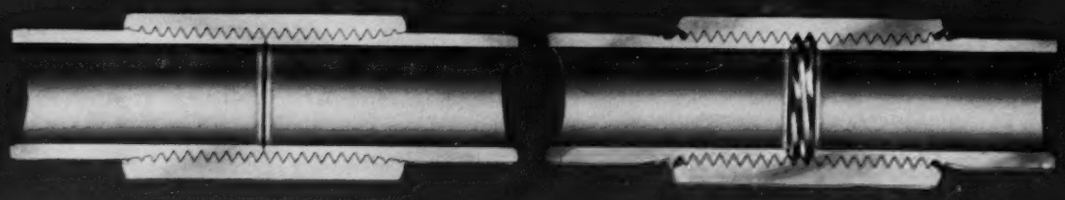
To Keep Wiring Safe

SHERARDUCT

Rigid Steel Conduit

with the

NE PROTECTIVE COUPLING



NE COUPLING—Sherardized rustproofed threads meet Sherardized rustproofed threads. No raw threads exposed.

ORDINARY COUPLING—Raw threads meet raw threads—accelerates rust. Threads exposed.

NATIONAL ELECTRIC PRODUCTS — NE — WIRES AND CABLES

National Electric

Products Corporation

Pittsburgh, Pa.

The Meaning of the Election

People are still seeking the meaning of the esults of the election four weeks ago. Does it ean, they ask, that a Republican administra- ion will be elected next year?

The average businessman, and certainly the reat majority of utility executives, would wel- ome such a change because they feel that the ew Deal administration has been responsible r a lot, if not most, of their hardships. How- ver, at the risk of being misunderstood we would ay that the important significance of this elec- on was not the foreshadowing of a change in dministration. The consequential thing is the use of such a change. Therein lies an ingredi- nt of far greater import to the entire electrical ndustry.

Eleven years ago the voters lost their con- dence in business leaders and, Esau-like, they rned eagerly to the governmental security ffered by the New Deal. That was during the mergency of unemployment and empty bellies. n the past two years, however, the greater emer- ency of national security has arisen, and in that me the people have had a chance to see that the eal strength of America is not the men of gov- rnment but the men of industry.

There is the big news of November 2. The eople of this country are beginning to under- and that government cannot give; it can only ke away. Industry gives employment and pportunity and an improved scale of living be- use industry creates. Government is not a reator; it is a spender. If it gives to one it is the expense of another.

Industry gathers powers by giving to others the greater freedom to enjoy more of the good things of life. Government gathers power by circumscribing the freedom of one segment or many segments of the public. This circumscribing of freedom when applied to business is called regulation—when applied to the public it is called regimentation. During the war industry supplied the materials and weapons of war which will turn what could have been defeat into victory. Government supplied the regimentation in the form of restrictions.

Those who would administer our government should learn from the November balloting, as well as several previous local elections, that the people now know what regimentation is, and do not like it. They should also learn that the public has seen that industry is capable of saving our nation from a fate far worse than temporary unemployment and as a result wants freedom to extend to enterprise that there may be continuity of opportunity.

To the electrical industry in particular this election portends a post-war period of great promise because there should be a large expansion of facilities for electric service unimpeded by an ever-present fear of government monkey wrenches.

It isn't a license to return to the fleshpots of the '20s; it is a command to do for America in peace as much as or more than it did for America in war. If the electrical industry is smart it will work together to obey this command and live happily ever after.

Watt-Hour Meters Compared by "Magic-Eye" Wink

Phototubes respond to speed differences which are disclosed as variation in degree of closure of magic eye — Departures detectable in one revolution

HEMPSTEAD S. BULL, Assistant Professor of Electrical Engineering, University of Michigan, Ann Arbor

SEVERAL ingenious photoelectric devices have been designed for watt-hour meter calibration, but some possess such disadvantages as requiring special rotating standards or special markings on the disk of each test meter. It is believed that the apparatus here described is comparatively free from such handicaps and in addition has features that will appeal to the practical meter tester. In brief, a "magic eye" is utilized to give a visual indication of the amount by which the test meter is slower or faster than the sub-standard.

The meter to be calibrated is mounted on a test rack in the normal manner. A light source above the meter and a phototube below are so placed (Fig. 1) that the rotation of the disk will permit periodic light pulses to reach the phototube through the anti-creep holes in the disk. The phototube is shielded from stray light disturbances by a suitable housing provided with a tubular "chimney" through which the desired light pulses enter.

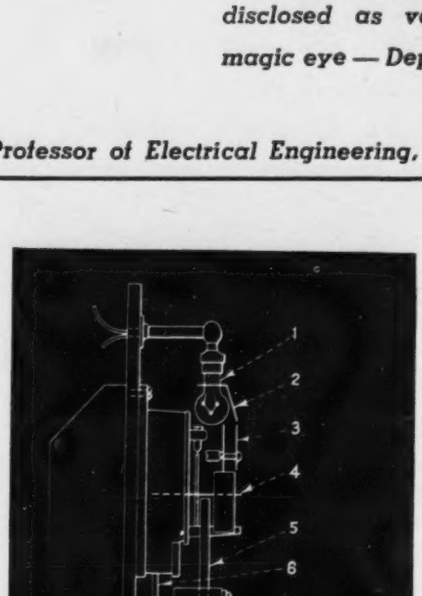


FIG. 1—Beam through anti-creep holes impinges on phototube below

1. 15-watt, 120-volt, lamp with candelabra base.
2. Glare shield.
3. Register.
4. Disk.
5. Phototube "chimney."
6. Line and load jumpers.
7. Phototube, type 921.
8. Shielded supply cable for phototube.

Electronic Equipment

A meter having the same disk constant, which has been calibrated against a rotating standard in the usual manner, is mounted alongside and provided with a duplicate light source and phototube (Fig. 2). A shielded flexible cable is employed to carry the phototube supply wires from the cabinet to the test rack. The meters are provided with a common load and a switch for energizing their potential coils simultaneously.

Cabinet contains a type 80 rectifier tube, a 6J7-G pentode and a 6E5 magic eye connected as shown in Fig. 3. The central dial on the cabinet face is used to adjust the bias on the control grid of the pentode and the dials on either side serve to adjust the phototube potentials. The magic eye can be made to open wide when both phototubes are obscured; with both phototubes illuminated simultaneously the eye will wink shut. If the disks are out of step by a very slight amount the eye closure will not be complete and when the amount of difference in disk travel reaches a certain critical value the eye closure becomes a noticeable double wink.

Operational Procedure

The following step-by-step procedure is recommended:

1. Mount the meters on the test rack and plug in their line and load jumpers.

2. Place each phototube housing the proper distance from the disk shaft, to permit light to enter the housing through the anti-creep holes. Turn the disks to shut off the light temporarily.

3. Turn on the power supply for the electron tube circuit and allow 30 seconds for the heaters to begin functioning.

4. Turn the bias control until the first grid of the pentode is made sufficiently negative to cause the magic eye to open wide. When this occurs the pentode is operating at cutoff.

5. Rotate one disk manually until a hole becomes centered over the phototube chimney. Adjust the corresponding phototube potential dial until the change in pentode bias produced by the phototube current is sufficient to cause the magic eye to become about one-third closed.

6. Leaving the disk in this position turn the disk of the other meter until a hole is centered over its phototube chimney. Now adjust the potential of this phototube until the magic eye closes completely.

7. Assuming that the current coils of the meters are already connected to the load, the meters may now be started simultaneously by closing the potential switch. There will be two complete eye closures per revolution

s long as the meters are running in tep.

First indication that the test meter s slow or fast will be an incomplete losure of the magic eye. Evidently he number of winks observed before ncomplete closure occurs will be inversely related to the percent error f the meter. Therefore before routine calibration work is attempted the peed of a suitable test meter should e adjusted to give it several successive error values just within and just eyond the limits of tolerance (by comparison with a rotating standard). For each error value a magic ye comparison should be made and count of the full eye closures taken. Thus the relationship between the umber of complete eye closures and ercent error may be determined.

Adjustment of the phototube potentials to give unequal magic eye esponse, as suggested in steps 5 and 6 of the operational procedure, will be found helpful in determining whether he test meter is fast or slow. For if he meters are permitted to run until he eye closure develops into a double wink, sequence of the unequal winks ay be observed and thus identity of he leading meter is established.

Speed of Action

Only a short time is required for a ormal calibration run as the phototube sensitivity is usually high enough o produce an observable change in ye closure when the disks are out of tep by very small amounts. This ill be evident from the following xample based on typical conditions:

Anti-creep holes in a G.E. 5-amp., wo-wire meter are located at a radius f 1.1 in. and are approximately 0.18 . in diameter. The circumference f the path of the anti-creep holes is 91 in. Assume that an observable hange in amount of eye closure will ccur when the test disk has dropped ehind the substandard disk about ne-sixth of the diameter of a hole, or 03 in., and that this occurs, in a parcular case, in one revolution of the ubstandard disk. The test meter is gging behind the substandard by

$$\frac{3}{91} \text{ or } 0.00535;$$

therefore it is 0.435 ercent slow. If 0.25 percent is the lerance in this case, only sufficient me for one revolution is required show that the meter needs adjustent.

Dale Latus and Lloyd Vroman, while students at the University of Michigan, were in large measure responsible for successful culmination of this development.

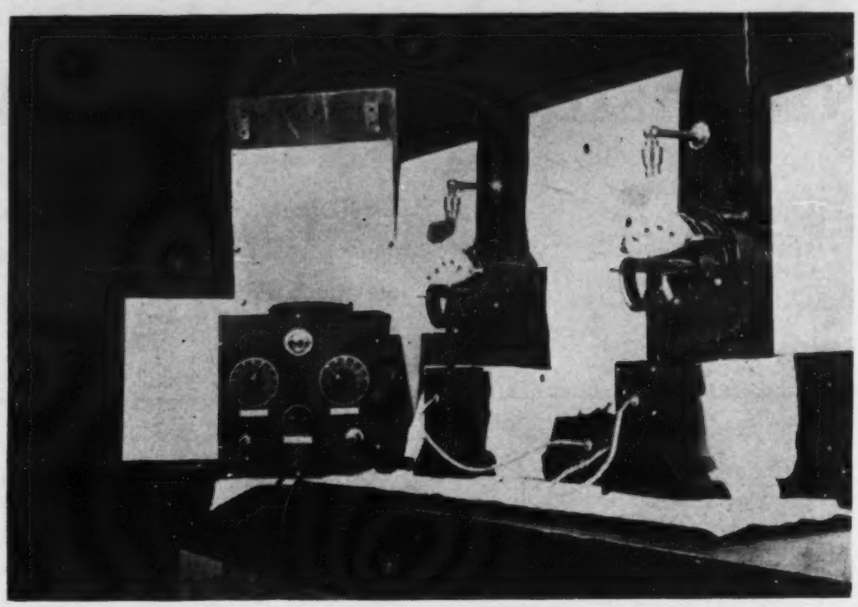


FIG. 2—Two meters compared by watching wink of magic eye at top of cabinet at the left

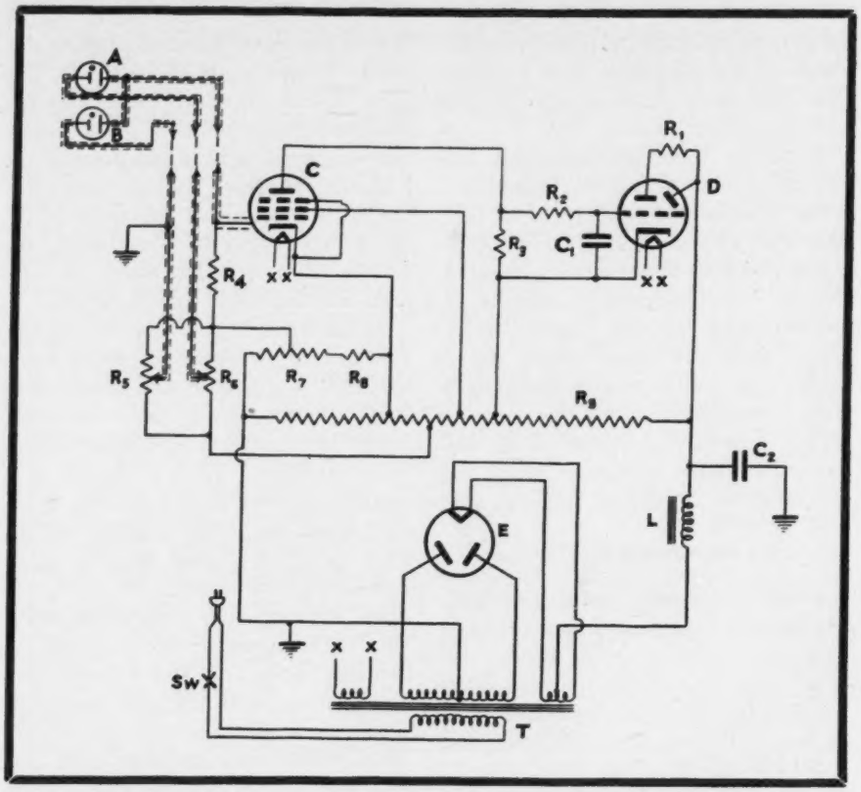


FIG. 3—Electronic circuits and controls for the actuating phototubes and the responsive magic eye (electron ray tube)

A, B	Gas phototubes, type 921.
C	Pentode, type 6J7-G.
D	Magic eye, type 6E5.
E	Rectifier, type 80.
R_1, R_2	1 mg., ¼ watt.
R_3	30,000 ohm, 1 watt.
R_4	2 mg., ¼ watt.
R_5, R_6	½-mg. potentiometer, with 50,000-ohm resistor connected from center to one side for proper taper.
R_7	2,000-ohm wire-wound potentiometer.
R_8	500-ohm minimum-bias.
R_9	30,000-ohm, 10-watt voltage divider.
C_1	0.1 mfd.
C_2	8-mfd. dry electrolytic.
L	30-henry, 30-ma. choke.
T	Standard "replacement" transformer, 115/350-0-350/6.3/5.

Phenolic Laminates as Insulating Materials*

Constituents and production processes — Significance and appropriateness of application of twelve standard N.E.M.A. grades — A.S.T.M. test methods and physical data for products of respective grades

S. A. RULON†

THERE is nothing new or startling implied by the use of phenolic laminates as insulation material; since their inception, about 35 years ago, they have been standard in a great many diverse applications. The newsworthiness of the laminates is because of the considerable number of recently invented or exploited electrical devices in which the peculiar properties of the laminates have brought them into many places where they had not previously been applied.

In many ways the laminates are unique among insulating materials. They possess a combination of mechanical, electrical and other properties which have not been duplicated despite recent seemingly comparable developments in the plastics field. True, there are many recent developments in laminates also, but basicly their constitution is still the same—a filling material in sheet form impregnated with synthetic resin and consolidated under heat and pressure.

The Manufacturing Process

Most commonly used synthetic resins are of the phenol formaldehyde type, which have been briefly discussed in an earlier article in this series. In addition, urea formaldehyde, melamine formaldehyde and combinations of these three types of resins find specialized uses. The filler is paper, cotton fabric, asbestos paper, asbestos fabric or woven fiberglas.

In the process of manufacturing these materials, the filler in the form of a continuous sheet is passed through a solution of the resin, by which means the filler is impregnated. It is then passed through a drying oven, where the solvent is removed and the resin partially cured. From this point the method of manufacture is determined by the end product desired. If sheets are to be made, the filler is cut in appropriate lengths, stacked between polished press plates, and subjected to heat and pressure in a hydraulic press. By this means the chemical reaction of the resin molecules is brought to completion, resulting in a product which is substantially infusible and insoluble.

If tubing is to be made the filler is continuously wrapped around a mandrel until the proper wall thickness is built up; the cure is then completed either in an oven or in a heated mold under pressure. Rods are made in a similar manner except that the mandrel is removed after winding and the final operation carried out in a mold; because of the applied pressure, the small-diameter hole left by the mandrel is eliminated in the pressing operation. Rods can also be cut from sheet stock and turned; since the laminations of this type of rod are axial rather than co-axial, their mechanical properties are more directional than is the case for molded rod.

These sheets, tubes and rods are the basic forms in which laminates are available and from these are produced shapes of greater or less complexity, depending upon the requirements of the application. Laminates can be shaved, sheared, engraved, punched, milled, tapped, drilled, turned and sawed so that the possibilities of machining are anything but limited.

N.E.M.A. Grades of Laminate

By using different fillers, different resins and different amounts of resin it is possible to produce a great number of grades of laminate. The National Electrical Manufacturers Association (N.E.M.A.) has canonized twelve grades of phenolic laminate whose properties cover a sufficiently wide range to make one or another of them suitable for almost any application. Besides these, each manufacturer has his own specialty grades, in which certain properties are emphasized in order to suit them for use where an unusual combination of requirements may be in effect. The N.E.M.A. twelve are: X, XX, XXX, P, XXP, XXXP, C, L, CE, LE, A and AA. At first sight this list seems to be confusing, but it becomes clearer when one realizes that it is based upon differentiation between the fillers involved as well as the type and amount of resin. Thus, Grades X, XX and XXX, P, XXP and XXXP contain paper as a filling material; C, L, CE and LE make use of cotton fabric; A has a filler of asbestos paper and AA of asbestos fabric.

X, XX and XXX—Of these three materials, X is based on Kraft paper and the latter two on special rag or alpha paper. Because of the more impregnation-absorbent nature of these latter papers XX and XXX have much better resistance to moisture than does X, although grade X is superior mechanically; XX is considered the general all-purpose grade of phenolic laminate because of its

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* This is the sixth in a series of articles treating plastics appropriate for electrical applications. Preceding articles appeared in the April 17, 1943; June 12, 1943; August 7, 1943; September 4, 1943 and October 16, 1943, issues of "Electrical World."

† Mr. Rulon was formerly with Technical Division, Continental-Diamond Fibre Company, Newark, Del.

articularly good balance of electrical and mechanical characteristics; XXX is superior to XX electrically because of its more complete resin-impregnation, but for this same reason it is necessarily slightly inferior mechanically. The water resistance of XXX is also the best of these three grades, and this point should be kept in mind because of the great tendency of absorbed moisture to impair the insulating properties of a given dielectric.

Various Grades

P, XXP and XXXP—These are the three paper base punching grades; they are made from a rag or alpha paper and are similar respectively to X, XX and XXX except that a different type of resin is used in order to enable them to be more readily plasticized when heated. For that matter, because of the nature of the resin used in these grades, it is also possible to cold punch where the thickness is not too great. Since in general the use of this type of resin makes for better water resistance, it should be noted that the electrical properties of grade XXXP, particularly in applications where exposure to severe moisture conditions is involved, are such as to make it the outstanding grade of laminate for use where dimensional and electrical stability under such conditions of moisture must be maintained.

C and L—These grades of laminate are chiefly used in applications where resistance to shock is more important than electrical properties. Their water absorption is relatively high and their electrical properties are not by any means as good as those of the paper base grades. The differentiation between the two is that grade C is made from a heavier weight fabric than is grade L.

CE and LE—When it is necessary to have both the superior shock resistance of the fabric base grade and the insulating properties necessary for a somewhat critical application grades CE and LE are used. They are similar to grades C and L as far as weight of fabric is involved, but they are more thoroughly impregnated. By this means a certain fraction of the mechanical properties is sacrificed in order to obtain a material which will be a better insulator.

A and AA—Neither of these asbestos grades is particularly stable electrically, but applications for them are frequently found where it is important that the laminate should possess dimensional stability and flame resistance.

Two Later Grades

These, then, are the standard twelve N.E.M.A. grades. There have not always been twelve for the development of the various grades has taken place over a period of years—originally there was only grade X. This was followed by the introduction of grade XX and later XXX. These two grades were developed on the basis of the discovery that the particularly absorbent type of paper used in the manufacture of vulcanized fibre would enable the manufacturer of laminate to obtain better impregnation and thus increase the water resistance of his materials. The cotton fabric base grades came next, followed by the three punching grades. The development of the asbestos base material has been even more recent. Nor has the development stopped at these twelve; for example, there is now available a grade of laminate in which the filler is woven glass fabric. This grade is outstanding in electrical as well as mechanical properties, although its price and unavailability under present wartime restrictions has limited its field of application. As an example of other variations possible in laminate, there can be cited certain paper base grades with particularly low dielectric loss properties and another which is so engineered that its dielectric strength parallel to the laminations is very much better than is the case for the standard materials. Further, it is possible by proper selection of fillers and resins to make grades whose resistance to chemically corrosive conditions is much improved.

These standard and special materials as well as a number of others suitable for certain more limited fields of application make use of synthetic resins of the phenol formaldehyde type. There is also used an appreciable amount of the urea formaldehyde resins, particularly for applications where light- or specially-colored effects are important, since the phenolic laminates are generally available only as "natural" (a golden brown) and black. Similarly, melamine resins or melamine urea combinations are now being used in instances where their superior resistance to low energy arcs becomes important. By far the greater volume of material is of the phenolic type. New grades are constantly being developed to meet conditions necessary for newly developing applications, but it has been found that in general the standard twelve grades furnish ample choice to satisfy the majority of cases.

Tests and Test Methods

Because it is obviously impractical to check the satisfactoriness of each and every insulating piece under actual operating conditions, a number of test methods are employed which measure more or less fundamental electrical characteristics. Closely defined test methods must be used in order to insure reproducibility of results. For this purpose A.S.T.M. Committee D-20 on Plastics and Committee D-9 on Electrical Insulating Materials have standardized on a number of procedures; of these the ones most commonly used cover power factor, dielectric constant, loss factor, dielectric strength, insulation resistance, arc resistance, water absorption and various physical properties such as tensile strength, fluxural strength and compressive strength.

Power factor, dielectric constant and loss factor. These are determined by the resonant circuit resistance variation method (D-150), in which comparison is made between the capacitance of a circuit containing the sample under test and the same circuit, but with air as a dielectric. Power factor is then defined as the ratio of the total power loss (in watts) in the insulating material to the product of voltage and current in a capacitor in which that material is the dielectric. Dielectric constant is defined as the ratio of the equivalent parallel capacitance of these two circuits. Loss factor is the product of the power factor and the dielectric constant and is a measure of the rate at which electrical energy is transformed into heat in the insulator. These three properties are particularly important at radio and higher frequencies, although they are often determined over as wide a range as from 60 cycles to 100 megacycles per

Table I—Properties of Phenolic Laminates, Based on N.E.M.A. Standards. Maximum and Minimum Values

N.E.M.A. Grade	Tensile Strength* psi. Maximum	Flexural Strength* psi. Minimum	Compressive Strength* psi. Minimum	Power Factor† at 10^6 Cycles per Second Maximum	Dielectric Constant† at 10^6 Cycles per Second Maximum	Loss Factor† at 10^6 Cycles per Second Maximum	Transverse Dielectric Strength‡, Volts per Mil—Minimum		Water Absorption‡ % 24 Hours Maximum
							Short Time	Step by Step	
X	9,000	16,000	.....	.....	...	....	500	300	6.0
XX	8,000	12,000	.....	0.045	5.5	0.25	500	300	2.0
XXX	6,000	12,000	.....	0.035	5.2	0.18	500	300	1.2
P	6,000	11,000	.....	.....	...	....	500	300	5.0
XXP	6,000	12,000	.....	0.045	5.5	0.25	500	300	2.0
XXXP	5,000	12,000	.....	0.030	5.2	0.16	500	300	1.2
C	7,500	16,000	35,000	.....	...	....	...	...	4.4
L	7,000	15,000	30,000	.....	...	....	...	...	2.5
CE	6,500	13,000	34,000	0.065	6.0	0.40	400	240	1.8
LE	6,500	15,000	33,000	0.055	5.5	0.30	400	240	1.8
A	5,000	10,000	30,000	.....	...	....	...	...	1.5
AA	6,000	15,000	35,000	.....	...	....	...	...	1.9

*Thickness 1/16 to 1 in. †Thickness up to 1 in. ‡Thickness—1/16 in.

second. In effect they measure the over-all efficiency of the dielectric. It should be noted that they are particularly affected by changes in moisture content, temperature and frequency, so that these factors should be taken into account when extrapolating experimental values into terms of operating conditions; during testing, of course, these conditions are carefully controlled.

Dielectric Strength

Dielectric strength is determined by A.S.T.M. Method D-229 or D-149. It is defined as a "measure of the voltage gradient which the material in question will withstand before an electrical failure or breakdown occurs." In most cases dielectric strength is expressed in terms of thickness; that is, as volts per mil. This is advisable because the value will be very appreciably affected by the thickness of the material, tending to increase to a considerable degree as the thickness decreases. A value determined for a thickness of 5 mils is by no means suitable for use in designing equipment where the dielectric will be, for example, $\frac{1}{2}$ in. thick. In the case of laminates, tests are made both perpendicular and parallel to the laminations, although the former test gives information of more general use.

Insulator and Arc Resistance

Insulation resistance (D-257) is the ratio between the voltage applied to electrodes fastened to or imbedded in the dielectric and the total current which flows between the electrodes. In the case of a solid insulator such as a laminate, the current may consist of two parts—that which flows through the surface layers and that which flows through the body of the material. The resistivity of the surface layers is particularly affected by surrounding humidity conditions due to the tendency for a film of moisture or dirt to be formed on the surface; however, since it is almost impossible to separate the influences of these two types of resistivity, the measured value generally consists of a combination of the two. Although no standard conditioning procedure is specified, the test is usually conducted after 96 hours at 90 percent relative humidity and 95 deg. F. These conditions are quite severe and will in most cases effectively evaluate the insulating material.

Arc resistance. This property is more properly "tracking resistance" than arc resistance. It is determined by Method D-495, in which a succes-

Table II—Properties of Phenolic Laminates, Based on N.E.M.A. Standards. Average Values

N.E.M.A. Grade	Tensile Strength* psi. Average	Flexural Strength* psi. Average	Compressive Strength* psi. Average	Power Factor† at 10^6 Cycles per Second Average	Dielectric Constant† at 10^6 Cycles per Second Average	Loss Factor† at 10^6 Cycles per Second Average	Transverse Dielectric Strength‡, Volts per Mil—Average		Water Absorption‡ % 24 Hours Average
							Short Time	Step by Step	
X	12,500	21,000	35,000	.....	...	....	700	500	4.0
XX	9,000	16,000	34,000	0.040	5.0	0.20	700	500	1.3
XXX	7,000	15,000	32,000	0.032	4.8	0.15	650	450	1.0
P	8,000	15,000	22,000	.....	...	....	700	500	3.0
XXP	8,000	16,000	25,000	0.040	5.0	0.20	700	500	1.3
XXXP	7,000	15,000	25,000	0.027	4.5	0.12	650	450	1.0
C	9,500	20,000	38,000	0.10	7.0	0.70	200	120	3.0
L	9,000	20,000	35,000	0.10	7.0	0.70	200	120	2.0
CE	8,000	17,000	36,000	0.055	5.5	0.30	500	300	1.5
LE	8,500	19,000	37,000	0.045	5.0	0.22	500	300	1.2
A	8,000	16,000	36,000	.....	...	....	225	135	1.25
AA	10,000	20,000	38,000	.....	...	....	...	...	1.5

*Thickness 1/16 to 1 in. †Thickness up to 1 in. ‡Thickness—1/16 in.

Table III—Properties of Phenolic Laminates, Based on Mean Values.

N.E.M.A. Grade	Tensile Strength* psi. Mean Value	Flexural Strength* psi. Mean Value	Compressive Strength* psi. Mean Value	Power Factor† at 10^6 Cycles per Second Mean Value	Dielectric Constant† at 10^6 Cycles per Second Mean Value	Loss Factor† at 10^6 Cycles per Second Mean Value	Transverse Dielectric Strength†, Volts per Mil—Mean Value		Water† Absorption %, 24 hrs. Mean Value	Arc Resistance Seconds Mean Value	Insulation Resistance, Megohms, After 96 hrs. at 90% R.H. 90° F. Mean Value
							Short Time	Step by Step			
.....	15,000	25,000	40,000	0.038	5.1	0.194	900	700	3.0	10	90
.....	12,500	18,000	38,000	0.036	5.0	0.180	800	600	1.0	4	500
X.....	11,000	17,000	38,000	0.030	4.7	0.141	800	600	0.8	4	800
.....	9,500	16,000	23,000	0.037	4.7	0.174	800	600	2.5	10	100
P.....	10,000	17,000	23,000	0.032	4.5	0.144	800	600	1.1	4	500
XP.....	9,500	16,000	28,000	0.026	4.0	0.104	800	600	0.7	4	2,000
.....	11,500	23,500	40,000	0.065	6.0	0.390	300	180	1.2	4	25
.....	10,000	22,000	38,000	0.040	5.0	0.200	500	300	1.0	4	.....
.....	11,500	23,500	40,000	0.065	6.0	0.390	250	150	1.1	4	.....
.....	9,500	22,000	38,000	0.037	4.7	0.174	500	300	1.0	4	100
.....	8,500	16,000	36,000	0.15	7.5	1.12	150	80	0.8	..	.....
.....	11,000	22,000	38,000	0.15	7.5	1.12	100	60	0.6	..	.....

*Thickness—1/8 in. †Thickness—1/16 in.

n of low energy arcs (increasing m an intermittent 10 milliamperes to a continuous 100) is flashed ween two pointed electrodes placed the surface of the material. Failure es the form of a conducting path up across the surface. Again, the dition of the surface is of consid- ble importance, not only during ing but during use, since forma- n of a film of dirt or moisture or ase may seriously impair the arc istance.

Supplementary Tests

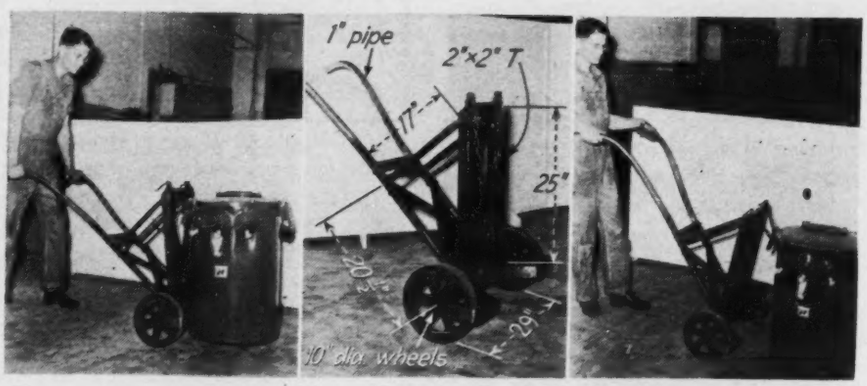
From these various electrical test thods a sufficient amount of infor- tion can be obtained so that it is sible to design effectively in al- st all instances. Occasionally other common tests are made, but it st be remembered that in all cases final measure of the suitability of material whatsoever in any appli- ion can only be completely proved actual trial. Test data, however re- ble they may be, do not always give complete picture. No material is olutely uniform and published a based on average or mean values not necessarily cover every indi- ual case. For this reason values usually listed as maximum or imum as well as average and e maximum and minimum are so sen as to indicate a safe working ge.

Since the electrical characteristics laminates are almost invariably superior to the requirements of a n application, the question of ther or not a published maximum e is actually the maximum ob- tainable for this material becomes somewhat academic.

N.E.M.A. has established standard properties for its standard twelve grades and these properties are usually those which are cited by the laminators. Since they not only consider these points but also cover the variations between the products of the several lamniators, these values can be considered as most authoritative; they are included in Table I as maximum and minimum values which are suitable for the writing of specifications. In Table II are average values suitable for comparison of grades. However, there have been no N.E.M.A. values established for such tests as insulation resistance and arc resistance, so that there is also included a third listing (Table III), in which *representative* values are given covering these various electrical tests for each of the twelve N.E.M.A. grades. By comparison of these three tables, it is also possible to understand more clearly the usefulness of these various types of data.

• • •

Transformer Dolly Built From Scrap Parts



Transformers up to a 25-kva. size with pressed steel tank, or 15 kva. with cast-iron tank, are lifted and trundled about the transformer testing and repair shop of the Kansas Gas & Electric Company with ease by one man using this "dolly." Built during the pre-war period from scrap parts, the device is now a highly prized shop accessory. Key dimensions of the dolly are indicated in the above illustration. Note that notches in the sides of the 2x2-in. T-section uprights permit adjustment of the lift chain to the height of the transformer.

Strand Connection and Guy Attachments

Résumé of practices and standards for making guy-strand connections poles, guy insulators and guy anchors developed by the Detroit Edison Company — Results of investigation and testing reveal reasons for adopti

W. E. LOSIE, Engineering Division, Detroit Edison Company, Detroit, Mich.

CRITICAL evaluation of pole line hardware performance, item by item and in its various functional groupings on overhead line structures, offers the individual utility a particularly fertile field, at present, for reorientation of construction standards and simplification of stocks to the fewest items that will serve all requirements.

Such an evaluation, for a given class of hardware, such as guy fittings, might encompass such considerations as: (1) What functions have to be performed by components of a given assembly; (2) what tests are necessary to establish ability to perform these functions; (3) what strength range is necessary to cover the spread; (4) how many functions and range values can be covered in one item of hardware; (5) how many pieces of hardware are needed as a minimum standard stock to do everything, and (6) what gains in operation, stores and inventory can come from a simplified line of hardware?

Present practices of the Detroit Edison Company in making guy strand connections to poles, guy insulators and guy anchors, here described, are the result of similar testing and investigation. Other alternatives to those outlined are feasible and, no doubt, may be preferred under different circumstances. However, these have proved most satisfactory under Detroit system conditions.

There are several important considerations in standardizing on guying construction: (1) Strand should be of proper strength; (2) clamps must be correct size and well tightened; (3) guy attachments should not be overloaded; (4) vertical loads on through-bolts should be well under the compressive strength of the wood of the pole or arm; (5) washers against wood should be of such size and shape as to prevent crushing the wood of the poles or arm under them; (6) equipment that is easy to install reduces the chances of faul workmanship, and this should carefully considered before adopti any new material; (7) guying pra tices should be continually studi and modified to meet changing co ditions and improved equipment.

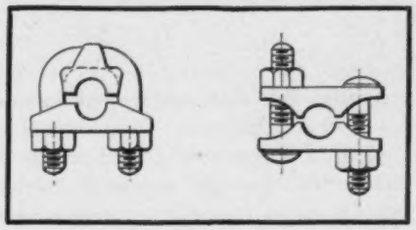


FIG. 1—Two U-type wire clamps used with guy strand

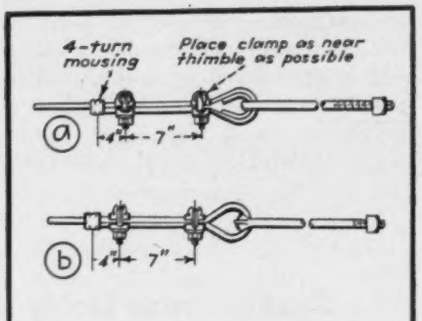
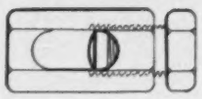


FIG. 2—Method of using U-type wire clamps for strand connection at (a) eyebolt or oval eye anchor rod, (b) at thimble eye anchor rod and (c) at insulator (shield tape used on 16M strand only)

FIG. 3—Slotted bolt clamp



Guy Clamps

U-bolt type clamps are used exclusively for strand connections on sizes of strand on the Detroit syst Clamps with a rider on the U-b or with two bolts instead of a U-b (Fig. 1) are preferred to the pla U-bolt type for reasons to be dev oped later. The number and size clamps used with different stra sizes vary as follows:

Strand Size	Connection At Insulators	Connection at Eyebolt, Gu Attachment, Anchor Rod and Wrap-Around Construction
3M	One 1/4-in. clamp	One 1/4-in. clamp
6M	Two 5/16-in. clamps	One 5/16-in. cla
10M	Two 3/8-in. clamps	Two 3/8-in. clam
16M	Three 7/16-in. clamps	Three 7/16-in. clam

Strand connections used under di ferent conditions are also illustra (Fig. 2). Formerly, ordinary s steel strand was used and connecti were made by serving. As loads i creased, however, high-streng strand was adopted which could be served due to its stiffness. Seve types of clamps were tested and a time smooth-groove three-b clamps adopted for 6M strand a U-bolt clamps for 10M and 16 strand. Smooth-groove clamps w chosen over the rifled-groove ty since they hold regardless of lay of the strand. Rifled grooves, the other hand, hold only when lay is the same as the clamp rifli The 3-bolt clamp used on 6M stra

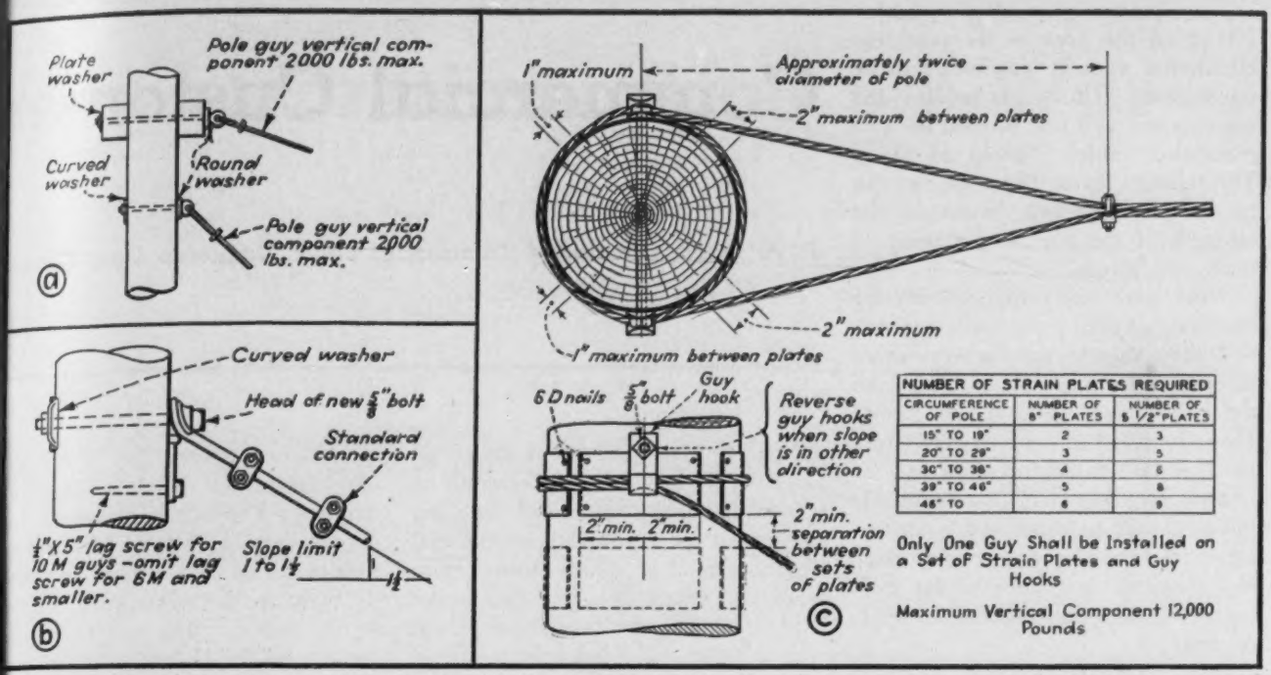


Plate washer
Pole guy vertical component 2000 lbs. max.
Curved washer
Round washer
Pole guy vertical component 2000 lbs. max.
(a)
Curved washer
Head of new 5/8" bolt
Standard connection
1/2"X5" lag screw for 10M guys - omit lag screw for 6M and smaller.
Slope limit 1 to 1 1/2
1/2
(b)
1" maximum
Approximately twice diameter of pole
2" maximum between plates
2" maximum
1" maximum between plates
6D nails
5/8" bolt
Guy hook
Reverse guy hooks when slope is in other direction
2" min.
2" min.
2" min. separation between sets of plates
(c)
NUMBER OF STRAIN PLATES REQUIRED
CIRCUMFERENCE OF POLE | NUMBER OF 8" PLATES | NUMBER OF 8 1/2" PLATES
15" TO 19" | 2 | 3
20" TO 29" | 3 | 5
30" TO 38" | 4 | 6
39" TO 46" | 5 | 8
48" TO | 6 | 9
Only One Guy Shall be Installed on a Set of Strain Plates and Guy Hooks
Maximum Vertical Component 12,000 Pounds

FIG. 4—Three methods employed for attaching guy to pole: (a) With eyebolt, (b) with guy fitting, (c) with wrap around construction

was subsequently replaced by U-bolt type clamps (without rider) when investigation and test showed that it held equally as well, was easier to install and the cost was lower. Served connections on 3M strand were discontinued in favor of U-bolt clamps, when it was found that strength of the served connections varied considerably due to difficulty of serving the stiff wire.

The ordinary U-bolt clamp used up to this point was discontinued when two new types of U-bolt clamps (Fig. 1) were tested and both proved to be an improvement over the design then being used. One clamp had a rider on the U-bolt and the other consisted of two clamping pieces and two bolts. These new clamps held about 1,000 lb. more than the plain U-bolt type. This increase was attributed to a movement of the two clamping pieces which tended to squeeze the strand tighter as the load increased. Either of these new type clamps is used in preference to plain types.

Other Clamp Faults

Several other type clamps were investigated and tested during this development period. Findings of the tests and the reasons these clamps were not approved can be summarized as follows:

1. Wavy-groove three-bolt clamp. Difficult to tighten enough so that strand will conform with the waves. Slipping started at 2,000 lb. load on ½-in. (7,400-lb.) strand.

2. V-groove U-bolt clamp. Superior to any clamp tested. One clamp broke 6M strand and two clamps broke 10M and 16M strand. So far as known, this clamp is not on the market in the United States.

3. Slotted-bolt type clamp (Fig. 3) Slotted hexagonal steel piece threaded to take a bolt with a convex end. It was hard to thread the strand through the slot and any slipping resulted in nicking the strand. Slipping started at about 2,400 lb. on 1.2-in. strand. This clamp was redesigned with anvil in the bottom of the slot, which spread the strands and forced them against the sides of the slot. This improved the holding power, but the other faults remained.

4. Wedge-type. Difficult to install. Clamp deformed the strand so that failure occurred below rated strength.

5. Heavy-wall copper twist sleeves. Developed full strength of the strand but difficult to install.

Guy Attachments

Guys are attached to poles and crossarms either with eyebolts, malleable iron guy attachments, or wrapped around the pole, depending upon the load and the slope of the guy. The accompanying table shows the type of attachment used with the various types of guys and the limitations of each attachment.

Details of guy attachment construction are shown in Fig. 4 (a, b and c). Formerly, all guys were wrapped around the pole. Shims were used to prevent the guy from cutting into the pole and three J-hooks, each held in place with a lag screw, were used to keep the wrapping in place. Shims were discontinued in favor of strain plates to simplify installation and the

Application of Guy Attachments

Type of Attachment	Type of Guy	Limitations
Eyebolt	Arm guy to crossarm	Max. horizontal component—11,500 lb.
	Pole guy to pole	Max. vertical component—2,000 lb.
MI guy attachment with through-bolt only	6M pole guy to pole	Slope not flatter than 1 to 1½ (1 vertical to 1½ horizontal)
MI guy attachment with through-bolt and lag screw	10M pole guy to pole	Slope not flatter than 1 to 1½ Max. vertical component—9,000 lb.
Wrap around	6M and 10M pole guys to pole	With slopes flatter than 1 to 1½
	16M pole guy to pole	With all slopes Max. vertical component—12,000 lb.

J-hook on the back of the pole was eliminated when it was found to be unnecessary. This made possible the use of a through-bolt to hold the two remaining (side) J-hooks in place. This change from three lag screws to one through-bolt improved the strength of the pole at the point of maximum stress.

Tests were run using eyebolts for attaching guys to poles and crossarms and they proved satisfactory where the vertical component of the load did not exceed 2,000 lb. At higher loads the wood in the bolt hole under the bolt fails in compression and the bolt slots the pole. This type of attachment is easier to install and is cheaper than the wrap-around construction and was therefore adopted for guys with vertical components of 2,000 lb. or less.

Prevent Slipping Guys

Guy attachment fittings were investigated and it appeared that they would save considerable installation time as compared with the wrap-around construction, since most of the work could be done on the ground. Mechanical tests showed that guys with a flat slope are likely to slip off the fitting which was being considered, so that their use was limited to guys with slopes steeper than 1 vertical to 1½ horizontal. These fittings are provided with two holes for attachment to the pole, one for a ⅝-in. through-bolt and the other for a ½x5-in. lag screw. Tests were made using the through-bolt only and it was found that the limit was about 6,000 lb. vertical load. When both the through-bolt and lag screw were used the fitting held 10,000 lb. vertical load without failure and with very little deformation. Loads above 12,000 lb. bent the through-bolt and moved the fitting down the pole for nearly 2 in. The final decision was to use the fittings with a through-bolt only for 6M guys with a slope not flatter than 1 to 1½, with a through-bolt and lag screw for 10M guys with a slope not flatter than 1 to 1½ and a vertical component not exceeding 9,000 lb.

Wrap-around construction was continued for 16M guys with a vertical component not exceeding 12,000 lb. and 6M and 10M guys with a slope flatter than 1 to 1½.

Commercial Customers Vo

F. A. KOLB, Director of Commercial Sales, Duquesne Light Company

ON THE Main Streets of towns all over the country are the thousands of stores that make up one of the most important parts of the commercial lighting market. These stores were rapidly changing to fluorescent lighting before the sale of equipment was stopped, and it has been predicted that this group will provide one of the best markets for fluorescent immediately after the war. A survey of the Main Street market in the Pittsburgh district shows that these predictions are well founded.

On Main Street today in that area nearly one-quarter of the stores have fluorescent for general interior lighting, with average intensities of around 17 foot-candles. The overwhelming majority of the owners of fluorescent equipment are satisfied with it and consider that their operating difficulties have been very few. They will recommend it enthusiastically to others.

All Know of Fluorescent

The incandescent lighting in the other three-quarters of the stores is 87 percent inclosing globes, with the intensity averaging around 9 foot-candles. Practically all of the store owners know about fluorescent; 20 percent say it will be the first thing that they will buy after the war; another 24 percent say it will be on their list of things to be bought soon after the war ends. Most of these people are thinking in terms of a fixture for fixture replacement—most of them in terms of bare lamp units. Only 9 percent say they will never buy it.

It appears as though the fixture companies can expect a volume market, with a big demand for moderately priced equipment. For the contractor and the fixture dealer the market is wide open, since very few people have decided on the place where they will buy. The utility companies can expect a slight decrease in connected load in the interior of stores, a sizable decrease in the windows, and gains in the cases. From a load-building standpoint the picture is not particularly encouraging unless the customers can be persuaded to put in higher intensities than they are now considering. In a mass change-over of this type it will be difficult to get good engineering on more than a small percentage of the jobs.

Bare Tubes, Mostly

One of the approaches to the commercial lighting market in the past has been through the contractors. A survey of representative contractors indicates that they will practically all recommend fluorescent to the Main Street stores. They are thinking in terms of bare lamp suspended fixtures in most cases, and they seriously doubt that many of their customers will buy lighting jobs with intensities around 50 foot-candles or better. Less than one-half of those interviewed said that they planned actively to solicit commercial lighting business.

All this adds up to the fact that the only way an outstanding lighting job can be done in the commercial field will be by the utilities, manufacturers, wholesalers and contractors co-operating on a fluorescent program that aims at levels far beyond the customers' present thinking. The utilities in particular must review their previous operations in the commercial field and recognize that during a mass change-over period they must have a promotional and educational program of a magnitude exceeding anything in the past.

Vant Fluorescent After the War

But Pittsburgh survey of the post-war market along Main Street shows that a lot of selling will be needed to prevent fluorescent from being just a lower cost replacement of incandescent

EFERENCE FOR BARE TUBES. Customers were asked which of these four kinds of installation they would buy. No. 1, bare bes suspended, was picked by 49 percent; No. 2, bare tubes continuous on ceiling, 15 percent; No. 3, bare tubes spaced on lling, 12 percent; No. 4, recessed, 6 percent

cked up with sufficient manpower, they expect to influence many of e jobs. Unless such a program is tablished they may find that the eat majority of the stores have mply doubled their lighting intensi- s with the same or less wattage, d then years will have to be spent ising the levels from the new base, most customers will be loath to ange their comparatively new uipment.

The Survey

This survey of the Main Street mar- t was conducted by personal inter- w; 45 business districts were ited in towns in western Pennsyl- nia, ranging from a population of 000 up to the city of Pittsburgh, h a population of nearly 700,000; 3,563 business places were inspected; 838 of these had fluorescent lighting for general illumination. Approximately every fourth place of business was interviewed.

Of these interviews 202 were with the customers having fluorescent for general lighting and 557 were with those using incandescent for general lighting; 51 contractors were interviewed, and 39 additional interviews were made with those customers with fluorescent window lighting.

The percentages shown in the tabulation of the survey are all figured on the basis of the totals in each of these four groups. In some instances the percentages shown may total more than 100 percent. This is due to the fact that more than one answer could be given to the particular questions. In other cases the percentages total less than 100 percent. This indicates that all of the people interviewed did not answer the question.

What Do Present Users Think?

The first thing we wanted to know was what the people who are now using fluorescent lighting think about it. To get the answer six questions were asked:

Q. Have your fluorescent fixtures and lamps operated properly since you installed them? A. 81 percent, yes; 19 percent, no.

Q. (The 19 percent were then asked) What have been your troubles? A. 16 percent, short lamp life; 13 percent, poor starters; 4 percent, poor sockets; 3 percent, ballast failures.

Q. Are you satisfied with your fluorescent lighting? A. 91 percent, yes; 9 percent, no.

Q. What do you like about fluorescent

light? A. 39 percent, more light; 21 percent, softer light; 13 percent, cooler; 18 percent, cheaper.

Q. What don't you like about fluorescent lighting? A. 13 percent, hard to replace lamps; 6 percent, color; 5 percent, too complicated.

Q. Would you recommend fluorescent lighting to others in the same business as yours? A. 91 percent, yes; 5 percent, no; 4 percent, I don't know.

It is evident from these answers that fluorescent has satisfied the vast majority of its present users.

Post-war Market

The next thing we wanted to know was what will be the post-war market for fluorescent lighting in the Main Street stores. To get the answer the following questions were asked of those people who do not now have fluorescent for general lighting.

Q. Are you going to buy fluorescent lighting as soon as it is available again? A. 44 percent, yes; 16 percent, no; 40 percent, I don't know.

Q. (Those answering "No" and "I don't know" were asked) If not, will you buy it some time? A. 19 percent, yes; 9 percent, no; 28 percent, I don't know.

Q. If you buy fluorescent lighting, where will you install it? A. 86 percent, general interior; 41 percent, windows; 17 percent, show cases; 15 percent, wall cases.

Q. Have you seen any fluorescent installations in your community that you like? A. 41 percent, yes; 59 percent, no.

Q. (The person being interviewed was then shown four photographs of typical fluorescent jobs and asked) These pictures show standard methods of fluorescent lighting. Which of these types of installation do you like? A. 49 percent, bare 4, 40-watt fixtures suspended; 12 percent, bare 4, 40-watt fixtures ceiling mounted; 15 percent, bare 40-watt lamps continuous on ceiling; 6 percent, recessed covered fluorescent units; 18 percent, did not care for any of the photographs or do not plan to install fluorescent.

Q. If you put in fluorescent lighting, how many fixtures would you probably install? A. 461 customers answered this question, and they gave a total of 2,558 fixtures. This is an average of 5.5 fixtures per customer. These same customers now have an average of 5.7 incandescent fixtures.

Q. How much would you spend for your fluorescent job? A. The average price given was $20 per fixture.

Q. (To determine how many customers might be sold 50 foot-candle jobs the customers were given a quotation on the probable cost of such a job, how many fixtures it would involve, and how the light they would have would compare with their present intensity. The question was then asked) Would you consider buying such a job? A. 25 percent, yes; 42 percent, no; 22 percent, I don't know.

As a final check-up on where lighting stands in the improvement program that these customers have in mind we asked the following question:

Q. What is the first improvement that you will probably make in your place of business immediately after the war? A. 20 percent, lighting; 12 percent, paint; 8 percent, new front; 4 percent, new cases.

We then asked those customers who now have fluorescent for general illumination:

Q. Do you plan to add any more fluorescent fixtures to your present lighting? If so, where? A. 41 percent, yes; 54 percent, no; 5 percent, I don't know; 18 percent, general interior; 14 percent, wall cases; 10 percent, windows; 9 percent, show cases.

From these answers it appears as though fluorescent lighting rates vary high on the list of improvements which the customers are thinking of making as soon as the war ends. One thing that is rather surprising is the large number of customers who are thinking of putting fluorescent in the windows, because many lighting people felt that most fluorescent window lighting jobs were unsatisfactory.

What Are Sales Problems?

The next thing we wanted to determine was where these customers would buy their equipment and from whom they would get their advice. To determine this we asked the people who had already bought fluorescent the following questions:

Q. Where did you get your advice on fluorescent lighting? A. 36 percent, looked at other fluorescent installations; 18 percent, Duquesne Light Company; 16 percent, wholesalers; 12 percent, electricians.

Q. Where did you buy your equipment? A. 38 percent, wholesalers; 17 percent, contractor; 16 percent, fixture dealer; 15 percent, manufacturer.

We then asked the customers who are using incandescent for general illumination these questions:

Q. Has any one ever tried to sell you fluorescent lighting? A. 76 percent, yes; 24 percent, no.

Q. Why didn't you buy fluorescent while it was still available? A. 38 percent, high cost; 25 percent, present lighting system satisfactory; 10 percent, too new; 7 percent, color.

Q. Do you have in mind any one in particular from whom you would buy fluorescent? A. 66 percent, no; 11 percent, wholesale; 7 percent, fixture dealer; 5 percent, electrician; 2 percent, manufacturer.

Q. If the Duquesne Light Company sold fluorescent fixtures, how would you feel about buying from us? A. 64 percent, favorable; 10 percent, unfavorable; 17 percent, I don't know.

Q. Would yon need any assistance in selecting a fluorescent lighting system? A. 72 percent, yes; 13 percent, no; 6 percent, I don't know.

Q. If so, to whom would you go for advice? A. 33 percent, Duquesne Light Company; 8 percent, dealer; 6 percent, electrician; 4 percent, wholesaler; 2 percent, manufacturer; 19 percent, don't know.

From these answers it appears that the customers have not decided whose equipment they will buy or where they will buy it. That so many people say they are going to get advice if they buy is reassuring, but 38 percent of those who now own it say they made up their minds by looking at other jobs. This shows the value of a good job in selling others, but it also indicates the necessity of a program to guide the customers' thinking.

What Can Utility Expect?

The next thing we wanted to know was what the utility company can expect in the way of load and revenue from lighting in the Main Street market after the war. To get the answers to this problem the following questions were asked of those who now have fluorescent lighting:

Q. Have you noticed any effect on your electric bill since you installed fluorescent? *A. 38 percent, lower; 5 percent, higher; 30 percent, no effect.

Q. Do you find that you are using your fluorescent lighting more or less than your incandescent lighting? A. 21 percent, more; 51 percent, same; 1 percent, less.

Q. Of what did your incandescent lighting equipment consist before you installed fluorescent? A. A comparison of the load before and after showed that the average decrease per store in the interior lighting was 276 watts. The window lighting represented a reduction in load of 67 percent. The reduction averaged 644 watts per customer. Case lighting averaged 250 watts gain per customer.

The following questions were asked of those who do not have fluorescent lighting:

Q. What do you think is the Duquesne Light Company's attitude toward fluorescent lighting? A. 59 percent, favorable; 10 percent, unfavorable; 31 percent, I don't know.

Q. What do you think will be the effect on your electric bill if you install the kind of fluorescent job you have in mind? A. 4 percent, decrease; 23 percent, no change; 13 percent, increase; 11 percent, I don't know.

Using the customers' answers to the question "How many fixtures will you install?" a comparison was made between the present connected load and what they say they will install. It was found that the average decrease per customer was 63 watts in the interior lighting. This compares with an actual decrease of 276 watts for those customers that now have fluorescent.

For the window lighting the prospective decrease is 740 watts per

*Some did not have incandescent before in same location.

Inventory

In making this survey we gathered certain inventory information on the Main Street commercial market:

The following tabulation shows the percentage of saturation of fluorescent in individual types of business:

	Percent
ood stores	18
earing apparel stores	31
ariety stores	30
siness offices	22
ting places	28
eauty and barber shops	18
ersonal service	21
eatres	0
neral parlors	0
rvice stations (buildings only)	3
me-furnishings stores	22
welry stores	29
door recreation	13

The foot-candle intensity was read at a distance of 3 ft. above the floor and an average of three readings taken, with the following results:

	Stores with Fluorescent Percent	Stores with Incandescent Percent
-10 foot-candles	25	68
-20 foot-candles	43	28
-30 foot-candles	23	3
-40 foot-candles	6	1
er 40 foot-candles	3	0

Of the customers with fluorescent for general lighting 93 percent are using bare lamp fixtures; 93 percent had individual units; only 1½ percent of the customers interviewed were using a combination of incandescent and fluorescent. It was found that on the average three lamps per customer were not in operating condition. The age of the lighting fixtures was found to be as follows:

Fluorescent Equipment	Percent
Less than two years	74
From two to three years	23
More than three years	3
Incandescent Equipment	**Percent**
More than five years	66
From three to five years	28
Less than three years	6

4. Types of incandescent interior lighting equipment are as follows:

	Percent
Enclosing globes	87
Semi-indirect	6
Bare lamps	5
Indirect	1½
Recessed reflectors	½

5. Types of incandescent window lighting equipment are:

	Percent
Window reflectors	76
Bare lamps	13
Reflector lamps	7
Inclosing globes	4

6. Average wattage per outlet for interior lighting 202
Average wattage per outlet for window lighting 136

stomer. This compares with 644 tts actual decrease per customer here fluorescent has been installed. It is quite apparent from these swers that most of the customers e figuring on installing a fluoresnt lighting job with the idea in nd of getting twice as much light the same money or less than they e paying now. The majority of the ople who have it probably tell hers that they save money on orescent. Apparently the utility mpanies have made progress in nvincing their customers that they e not opposed to fluorescent light-

Fluorescent Window Lighting?

Since the window lighting load ems to be the one most in jeopardy m fluorescent, a survey was made some of the customers with win-w lighting to determine how they e it. In the original group of 202 that had fluorescent for general lighting 25 percent of them had some fluorescent in the windows; 39 installations were selected where the customer had considerable fluorescent in the windows and the following questions were asked:

Q. Are you satisfied with fluorescent in the windows? A. 85 percent, yes; 15 percent, no.

Q. When you installed fluorescent in the windows what was your main reason for buying? A. 56 percent, lower cost; 38 percent, more light.

Q. Do you think you will add any additional lighting in the windows? A. 26 percent, yes; 74 percent, no.

Q. How has it affected your bill? †A. 64 percent, lower; 15 percent, same; 0, higher.

Apparently fluorescent window lighting is a factor that will have to be considered.

What About the Contractor?

We then tried to determine what the attitude of the electrical contractor was toward fluorescent and what he expected to do about it in the Main Street market. In order to determine this we asked the following questions:

Q. If restrictions were lifted would you recommend fluorescent lighting to stores, schools, offices, churches? A. 94 percent, stores; 76 percent schools; 98 percent, offices; 20 percent, churches.

Q. What advantages do you think the customer would obtain from fluorescent? A. 76 percent, more light; 47 percent, lower operating cost; 45 percent, easy on eyes.

Q. In selling fluorescent lighting installations do you recommend higher, lower, or the same intensity as that obtained from incandescent? A. 79 percent, higher.

Q. How do you determine the number of fluorescent fixtures a customer should install?‡ A. 21 percent, same number of fixtures as at present; 24 percent, more fixtures than at present; 6 percent, fewer fixtures than at present; 59 percent, design it or get some one else to design it.

Q. Here are pictures of several types of fluorescent fixtures. Which types do you generally recommend to your customers? A. 76 percent, bare 4, 40-watt fluorescent suspended unit.

Q. (The requirements for a 50-foot-candle job were then described and the question asked) Do you have any customers that you think would buy such a job? A. 33 percent, yes; 29 percent, no; 35 percent, I don't know.

Q. After the war do you plan to solicit commercial lighting business by actively contacting customers? A. 41 percent, yes; 31 percent, no; 27 percent, I don't know.

Need for Educational Effort

It appears as though the majority of the contractors will probably go along with the trend to fixture-for-fixture replacement, using bare lamp fixtures, unless they are included in an all-industry educational and promotional program.

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Shielding Angle

In the article by Messrs. Church and Stebbins, "110-kv. Tie Line Uses Progressive Design" (ELECTRICAL WORLD, October 30, 1943), there appeared the statement, "latest available data indicate that an angle of not over 15 deg. is desirable between the ground wire conductor and a vertical plane through the power conductor." This should be corrected to read "an angle of not over 30 deg. is desirable between the vertical plane through the ground wire conductor and the plane passing through the ground wire and power conductor."

† Some never had incandescent.

‡ Some gave more than one answer, saying the method they would use would depend on the size of the job.

Generator Bus Regulation Gives Superior Results

Better over-all regulation, increases kva. capacity and leading current contribution, decreases transformer excitation losses and breakdowns, minimizes deleterious harmonics, releases feeder regulators

D. R. PATTISON, Pennsylvania Electric Company, Johnstown

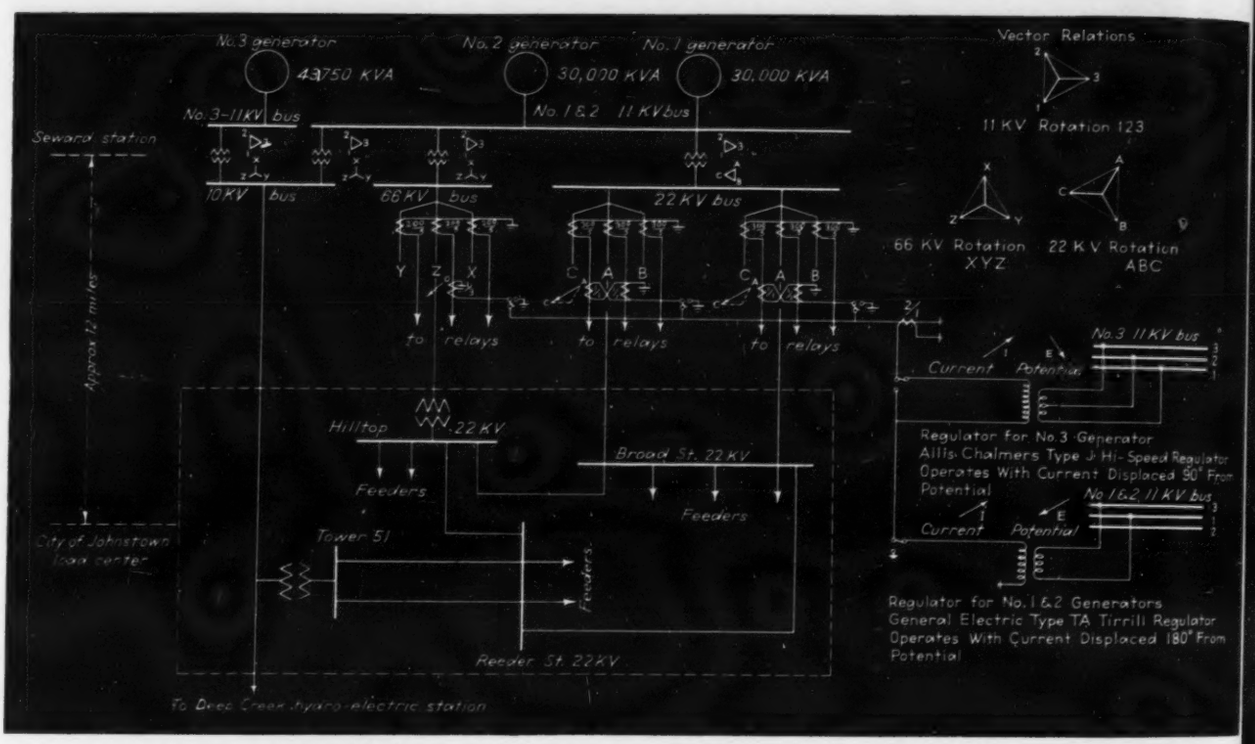

FIG. 1—Two 22-kv. and one 66-kv. feeder into Johnstown area sampled for synthetic current which compensates generator regulators for drop to feeder load centers

GENERATOR bus voltage regulation for over-all line drop compensation is an old chestnut, but it seems that in the rapid growth of the power industries it has taken a back seat in favor of constant bus voltage and separate feeder regulation at, or near, the load center. Generator bus regulation has many recognized advantages, but these advantages have seemingly been neglected, due to the apparent difficulties involved. The advantages and economies, in our case, have far outweighed the difficulties. It is for this reason that we outline here some of the experience gained in setting up the scheme. The over-all results have been gratifying and the effort found well worth while.

Some of the advantages gained are as follows:

(a) Better over-all system voltage regulation.

(b) Increased transmission capacity, due to higher voltage operation during peaks.

(c) Decreased need for separate feeder regulators.

(d) Gains leading kva. due to higher voltage transmission excitation during peak loads, when it is desirable, and decreases it during off-peaks, when it becomes a burden.

(e) Lowers transformer excitation losses by lowering voltage on off-peak periods.

(f) Minimizes danger of insulation break down on transmission and distribution equipment from over-voltage on off-peaks.

(g) Minimizes static capacitor failures due to overheating from fifth harmonic absorption, generated by overexcited transformers on off-peaks.

It was the latter item which brought about an effort on our part to remedy the static capacitor failures that led to the adoption of automatic generator bus voltage regulation. We first tried scheduled hand regulation of the generator bus voltage by 8 to 10 percent, and, although this did partly overcome our trouble, it was generally unsatisfactory for it was found that old man habit just could not be broken down over night. Also, the schedules were usually too late, too early, too much or not enough.

It was obvious that if we could utilize certain transmission feeders to reflect an indication of the load condition to compensate generator voltage regulators we could overcome the human element. Although we could not expect to compensate for the drop on each individual feeder circuit, it has been found that, with the exception of a few heavy industrial feeders, the load variation over the system does follow a fairly even pattern. It was also felt that the more transmission feeders that could be sampled, feeding a common load center, the better would be the diversity.

As one of our major generating stations is located at Seward, Pa., some twelve miles from the load center at the city of Johnstown, it was decided to use the current from as many of the feeders supplying this load center as possible.

Several Feeders Sampled

Although several schemes were tried, first one feeder, two feeders, the final set-up is as shown in Fig. 1, where two 22-kv. feeders and one 66-kv. feeder were grouped for this purpose. Their currents were added through separate low ratio current transformers placed in the current transformer secondaries from the separate feeder circuits. The current transformer ratios were selected to furnish a normal rated current to the regulator compensating coils, and giving approximately the same current per kva. from each of the three circuits. On the basis of a total load of 30,000 kva. at the load center, which, for illustration, we will say is evenly distributed between the 22-kv., 66 kv. and 110 kv. circuits, and as the 110-kv. feed is neglected as explained later, this leaves approximately 20,000 kva. for the 22- and 66-kv. circuits. As a large portion of the load dropped by the failure of either 22-kv. circuits will show up on the remaining 22-kv. circuit and the 66 kv. circuit, we made the current per circuit per kva. equal. For example: The equivalent current of 10,000 kva. at 66 kv. and 22 kv. are 87.5 I. and 263 I. respectively. In taking the C.T. ratios of one 22-kv. circuit we have

$$\frac{263}{60} \times \sqrt{3} = 7.56 \text{ amp.}$$

The square root of 3 function comes into the transformer ratio from the cross-connected 1-to-1 current transformers and was done to put the 66 and 22-kv. currents in phase.

The 66-kv. circuit will have

$$\frac{87.5}{40} \times 3 = 6.5 \text{ amp.}$$

This value is close enough to the 22-kv. current for practical operation. This would give a total current of 14.06 amp., which was found to be too much for the regulator coil. Hence, the 2 to 1 C.T.'s were added when the 66 kv. feeder current was included in the sampling.

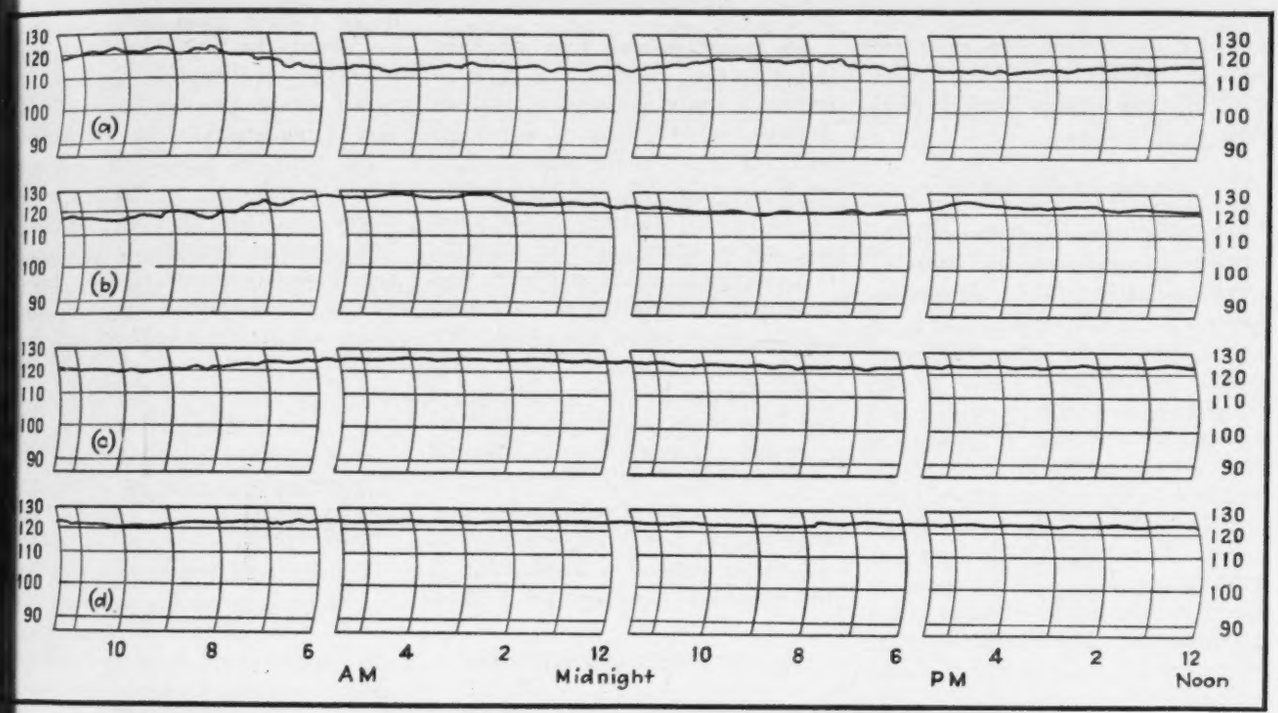

FIG. 2—Automatic regulation of generator bus voltage gives flat voltage at 4-kv. load center

(a) Chart taken at 11-kv. bus in Seward generating station with voltage regulated to give load center voltages of chart d.

(b) Chart taken at 4-kv. Johnstown load center with no regulation but with 11.7 kv. maintained at Seward bus.

(c) Chart taken at 4-kv. Johnstown load center with generator voltage at Seward maintained by hand.

(d) Chart taken at 4-kv. Johnstown load center with generator voltage automatically regulated at Seward by scheme of Fig. 1.

The two 22-kv. circuits from the tower 51 substation, which receives its power from the main 110-kv. transmission system, and may be fed from either the Seward steam plant or the Deep Creek hydro plant, are not included in the picture as it would be impossible to get a true reflection of this power at the Seward plant except by telemetering, which was not thought justifiable at this time. The omission has not caused any particular difficulty for, during normal conditions, the feeders used do reflect a good proportionate picture of the actual load and only during time of line outages is this ratio slightly upset. Actual outage time is usually short, and we find that during such times additional compensation can be cut into the regulator, or simply using the hand regulation during outage period gives fairly good results.

Setting Up the Range

Setting up of the generator regulator was accomplished by selecting a representative 4-kv. Johnstown feeder, cutting out its induction regulators, and, with recording voltmeters at the feeder's load center, the generator voltage regulator was adjusted to maintain a fairly constant voltage at the load center. By referring to the voltage charts (Fig. 2) a better idea of the actual operation can be gained. Chart (b) represents the condition as it existed on this particular feeder without either generator or feeder compensation, over a Sunday noon to Monday noon cycle. Chart (c) gives a similar cycle on the same feeder with hand regulation, and although the condition has improved, it is not satisfactory.

Charts (a) and (d) were made at the same time, chart (a) being the regulated 11-kv. Seward generator bus voltage compensation for overall drop to the Johnstown load center. Chart (d) was taken at the same location and under similar load conditions, but at different periods than charts (b) and (c).

No Off-Peak Difficulties

There was some anxiety during the adjustment process as to just what would happen to the rest of the system, especially to tie lines to our neighboring power companies. As we had made several studies on the a.c. network analyzer, most of the troubles were anticipated. Due to our relatively small system and rather flexible nature of our interconnections, no great trouble was encountered. The worst difficulty was anticipated during our off-peak periods, when our regulators would cut the system voltage to a point where the tie lines from our neighbors would take most of the reactive component from our system and leave our machines underexcited. This condition in actual operation did not become serious as it only amounted to some 4,000 or 5,000 r.kva. and, as in most other problems, the co-operative handling of the condition soon straightened it out.

Up to the present time we have installed the automatic regulation feature in only one station, and we depend entirely upon a scheduled hand regulation at the other stations on our system. We find that the inherent natural tendency of the plant and system operators is to keep the system reactive well distributed, thus seemingly keeping the entire system voltage on a fairly even keel. We do, however, intend installing automatic control on the generators at the Erie Front Street plant and, as time and equipment are available, all our generators will be controlled over some form of telemetering system for, as has been pointed out, automatic regulation is superior to the scheduled hand control method.

Group Compensation Effective

A survey of the voltage conditions at numerous load centers in the Johnstown area, as well as spot checks in remote areas, have indicated that, except for heavy industrial feeders, which do not operate on a common load cycle with the rest of the system, and remote parts of our 22- and 33-kv. transmission system, which require more than the normal compensation, a great majority of the system loads can be effectively over-all-line-drop compensated from the generator bus.

An unexpected by-product of overall regulation has been that, due to the relatively large amount of high-voltage transmission (about 550 miles of 110/132 kv.) which produces a sizable amount of leading kva., which at off-peaks has proved undesirable, the generators may become underexcited to the instability point. However, by varying the transmission voltage approximately 10 percent we find that we lose approximately 14 percent of this leading reactive and, of course, we gain a like amount on the peak-load period, when it is desirable.

Adjustments

In the system adjustments necessary during the setting up of this scheme some transformer taps had to be changed. In general, the ones nearest the power sources were lowered by about 5 percent, while those in the remote areas were increased by about the same amount, thus providing an over-all system balance, which would give the fullest advantage to the generator bus regulation.

No estimates of savings or losses have been made, as they are extremely variable. They are, nevertheless, sizable quantities, and until actual measurements can be made, over a period of time, they will have to be left to the imagination.

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Linemen's Tools Kept Safe

On the loading dock to which line trucks back up in the warehouse of the Virginia Electric & Power Company at Richmond there stands a large cabinet-like structure made of wood and comprised of 54 horizontal lockers. Each locker is 14 in. high, 30 in. wide and 15 in. deep and has a door hinged at the bottom and with hasp and padlock at the top. The structure is six lockers high, about 8 ft., and nine lockers wide, about 24 ft.

Each lineman is assigned a locker. When he is finished work for the day he takes his tools off the truck and locks them up. This not only keeps the man's tools safe but also avoids the possibility of him and his tools getting separated. A truck might be sent out on a trouble job with other than its regular crew. If it were the practice to leave tools on the truck the men to whom they belonged might have to do a lot of chasing around in order to get hold of them.

Small Currents Pass Spray Nozzle Mist

Demonstrations at 6 ft. from 144-kv. screen show values less than ¼ milliampere to convince utility employees of safety in fighting oil fires

S. BASS* and A. E. FEHLENBERG, Union Electric System, St. Louis

SE of water around high-voltage uipment is traditionally regarded as ngerous by electrical men. In the t few years, however, water has me into widespread use in the form fog or fine spray for fighting oil es in power plants and substations. though authoritative information the safety of this practice is avail-le, the Union Electric Company resorted to several actual demon-tions as being more effective in vincing employees of this truth.

These safety demonstrations took form of a series of tests using va-us makes of fog nozzles. Spray m the nozzle was directed on a cial metal screen measuring 9x10 suspended on insulators and con-cted to one conductor of a 132-kv. nsmission line. In another series tests the screen was connected to one conductor of a 66-kv. line. Current flowing from the screen to the nozzle was measured with a rectifier type microammeter connected between the nozzle and ground. The accompanying sketch shows how the screen and measuring instruments were connected.

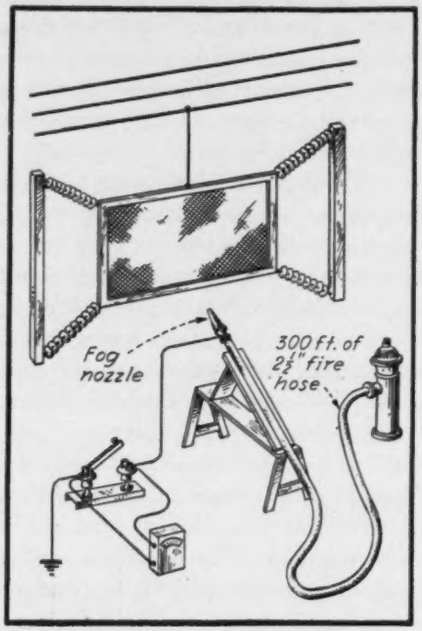
The accompanying table shows the results obtained on various nozzles identified as A, B, etc. Most of the tests were made 6 ft. from the screen. Maximum current measured, shown in column 7, was 0.000275 amp., which, according to information from authoritative sources, would not be felt by the average person.

Raw river water having a resistance of 2,480 ohms per centimeter cube was used. In tests 5 and 6 of the table, salt (sodium chloride) was added to lower the resistance of the water. The addition of the salt, although reducing the resistance of the water to 54 ohms per centimeter cube, did not increase the current flowing from the screen to the nozzle.

Calculations indicated that the current flowing through the column of water in the hose to the fire plug, 300 ft. away, was in the order of 0.5 microampere. When the salt was added this current increased to 16.0 microamperes, which was still too small to influence results of the test.

*Protection Co-ordinator.

HIGH-VOLTAGE LEAKAGE TESTS on fog nozzles show utility employees that water in form of fog or fine spray is a safe substance for fighting oil fires in high-voltage equipment



TEST SET-UP for measuring leakage current in fog nozzle spray directed against high-voltage equipment; ammeter measures current from nozzle to ground

High-Voltage Leakage Test on Fog Nozzle Spray

Test Number 1	Make of Fog Nozzle 2	Nozzle Size-In. 3	Nozzle Distance from Screen-Ft. 4	Line to Line Volts 5	Line to Ground Volts 6	Current Passing from Nozzle to Ground Amperes 7	Kind of Water Used 8	Water Pressure at Plug Lbs. per Sq. Inch 9
1	A	2½	10	144,400	83,400	0.000152	Raw river	82
2	A	2½	6	144,400	83,400	0.000275	Raw river	82
3	B	2½	6	144,400	83,400	0.000272	Raw river	82
4	A	1½	6	144,400	83,400	0.000261	Raw river	84
5	A	1½	10	144,400	83,400	0.000128	Salted raw river	80
6	A	1½	6	144,400	83,400	0.000210	Salted raw river	80
7	B	1½	6	144,400	83,400	0.000250	Raw river	75
8	C	1½	10	144,400	83,400	0.000155	Raw river	..
9	C	1½	6	144,400	83,400	0.000272	Raw river	..
10	D	1½	6	144,400	83,400	0.000248	Raw river	83
11	A	2½	6	70,200	40,500	0.000120	Raw river	75
12	B	2½	6	70,200	40,500	0.000125	Raw river	75
13	A	1½	6	70,200	40,500	0.000113	Raw river	82
14	B	1½	6	70,200	40,500	0.000118	Raw river	80
15	C	1½	6	70,200	40,500	0.000118	Raw river	80
16	D	1½	6	70,200	40,500	0.000117	Raw river	80

Editorials

S. B. WILLIAMS, *Editor*

Thankful for the Opportunity to Serve

THIS is Thanksgiving week, but this year, though mindful of its blessings in terms of present and future prosperity, the electrical industry is thankful that it was able to serve its country so well in this great war for national and personal freedom.

The public is perhaps apt to think of this as a war of airplanes, tanks, submarines and other death-dealing machines, while we in industry are conscious of the fact that they are but the end results of the ceaseless operation of the rapidly expanded machinery of our mines and mills.

In this miraculous achievement of the Arsenal of Democracy, the electrical industry has taken an important part. Not only were the electrical manufacturers called on to power virtually every war manufacturing machine and process but they also engaged extensively as contractors of war material, not only the electrical equipment for the war machines of land and air and sea but for war munitions. The wholesalers never let war production suffer for want of electrical equipment, while the contractors who had wired the factories of America saw that their work was good. And over the whole scene was ample power wherever needed, whenever wanted.

It is a grand thing to be able to have that feeling of participating in victory. Without taking away one iota of the credit due the men in uniform, the men and women and the managements of the electrical industry must feel a great satisfaction in having held firm a post of honor where any breakthrough would mean tremendous losses all along the front. Others could weaken and falter, but not electricity. It was for the opportunity to hold that line and by so doing to help bring victory nearer that the electrical industry is thankful. But even more so is the industry thankful for the strength and the will to overcome the insurmountable obstacles in its effort to serve war without adding to civilian deprivation.

Manufacturers Need Utilities in Market Development

SEVERAL GROUPS of electrical manufacturers are now planning co-operative marketing programs, with the utility in each case the focal point around which the program is expected to move.

Before the war when the dealer was being wooed assiduously by the manufacturer there was an inclination more and more to disregard the utility when making sales plans. The utility might be instrumental in creating a market but not in making brand sales, so the promotional effort was made elsewhere. That was a mistake because it tended to break down the essential feeling of interdependability.

Regardless of whether or not a utility sells any merchandise over the counter, it is the most important factor in the promotion locally of any electrical device to go on its lines. Any manufacturer who ignores this basic fact will live to regret it, while those who have carefully cultivated the utilities and have worked closely with them in the development of the market have never had any reason to regret their policy.

Sometimes manufacturers are critical of the utility companies because they do not make a larger contribution to local promotion. Simply because the utility cash register rings year after year, while the manufacturers' ring but once, is no reason for any manufacturer to take the attitude that the utility owes him or his products something. When such a feeling exists no good is accomplished.

While it is encouraging to see these programs now in the making and back on the sound basis of interdependability, one cannot help feeling that so much more might be accomplished if only there were some national co-ordinating agency.

FPC Rescinds Washington Common Carrier Order

WHILE the common carrier principle contained in the President's directive of a year ago was not necessarily killed by the Federal Power Commission's rescinding of its Washington Water Power order, it did receive a nasty jar.

Pursuant to the President's directive FPC had set up rules, and among them was the 1,000-kw. minimum. In order to bring two Army loads, one for a camp and the other a hospital, above the minimum their loads were lumped despite the fact that they were not commonly metered and, in fact, were across the river from each other. The estimates of 1,200 kw. initially and 1,700 kw. ultimately were accepted in spite of the fact that at the hearings in April the power company showed that the estimates were highly excessive.

The unfortunate thing about the entire proceeding

hat the Federal Power Commission, which is supposed o be an unbiased regulatory body, apparently took no teps to find the facts after the hearing, or if it did have he facts it took no action until last week. The rescinding rder was issued on November 17, after being advised by Bonneville on October 5 that even then the combined loads ad not exceeded 366 kw.

The obvious conclusion is that the commission issued he rescinding order reluctantly, that it would have preerred to have let the matter drift to oblivion without urther decision.

The whole thing has been very unfortunate both for he utilities and the commission. The President suggested hat the commission make his directive effective by using s emergency powers under the Federal Power Act. It is ighly doubtful that the commission has any authority to et aside contracts or local regulation except in a case of ower emergency, and then only for the emergency. nd, also, regardless of the fact that the President took ains to point out that no discrimination as between rivate and public power was implied, one could not elp feeling otherwise about the reasons back of the irective.

Advertising Has a Second Birthday

EXT WEEK the electric utility national advertising proram will be two years old. Starting with fifty-two comanies the first of December, 1941, this co-operative proram is now being financed by 157 companies that serve lose to 50 percent of the residential meters connected to nes of private companies.

As the list of contributors expanded and more money ecame available, the program widened, so that where here were but five magazines used in 1941 the advertising ill go into its third year with eighteen national magaines and a weekly radio program over 127 stations. In ldition, newspaper advertisements are now appearing twelve to fifteen hundred newspapers each week over e signature of the local company.

Slowly but surely this program is giving the public new insight into the contributions the power industry as made to American economy as well as telling the role is playing in the war. The effect is beginning to be oticed and will be more pronounced as the program ntinues.

To round the program out, however, some attention ould soon be given to news and publicity releases. hat would enable the industry to get additional informaon of a different nature before the public. All these ings, however, require money. It is hoped that in its ird year the program will attract considerable addional support from companies that so far have been ridg on free passes.

It is also to be hoped that during its third year the rogram will have been accepted as something permanent and discard the temporary appearance created by its anonymity. The child is a good child. It hasn't disgraced its parents or got them into any trouble. It's time it had a name.

Its Enemies Have Made It Strong

LAST WEEK'S issue of ELECTRICAL WORLD reported the issuance by the Federal Power Commission of the financial record of the electric utility industry for the six-year period 1937 through 1942. It must have been a shock to those who were ready to write the industry's epitaph.

When the 1943 figures are added it will be apparent that one of the strongest industries financially to enter the post-war era will be that devoted to the business of electric light and power. The commission takes credit for this achievement largely as the result of the operations of its uniform system of accounts. That, of course, is a matter of opinion. There is no doubt but that considerable credit is due the commission, but more is due to the foes of the industry who attacked it on every side.

While this may sound like a wild statement, the fact remains that these repeated attacks, instead of destroying the companies, had the effect of strengthening them. The pressure for lower rates has brought operating practices that have greatly improved the companies, while the attacks on the financial structure have brought practices that make it stronger and less vulnerable.

There never was anything terribly wrong with the industry's finances, at least on the operating company level. Considerable adverse publicity has been directed at write-ups, but through 1942 all that the FPC had been able to chisel off was only 1.1 percent. Before it gets through with its drive it may possibly raise this to 5 percent, but even so that isn't enough to make such a big howl.

The big thing that has happened in all of this disturbance has been to make the industry more self-sufficient financially. In the '20s it had ready access to the money market, but after the depression set in and the New Dealers got busy on the industry it wasn't so easy to get new money. That meant that expansion was denied unless some other source of capital was found. The industry found it in its reserves, which have been greatly increased. When we emerge from this war the industry can expand as fast or faster than ever before and without fear of a money shortage.

Let it not be understood, however, that this is a final report; it is only a report of progress. With its financial health restored the industry is now ready for a big program of expansion and greater public service. It slipped like a lot of others under the spell of easy living in the '20s. A lesson, however, has been learned and it should never slip again. By constant vigilance and alert management there is no reason why the electric utility industry should not resume its position of leadership in American industry.

Washington Comment

R. N. LARKIN, Washington Correspondent

Ordnance Plant Power to Firm Up Public Hydro

AT LEAST one angle of the broad question of what to do with government-owned war plants when the fighting stops is causing no indecision on the part of Washington's post-war planners.

Regardless of what happens to the rest of the $39,000,000,000 worth of plant financed and erected by the government since the defense drive began nearly four years ago, the steam-driven electric generating capacity—somewhat more than 300,000 kw. worth—which has been installed in 17 Army ordnance plants, most of which dot the eastern half of the United States, is as good as under option to existing government agencies which own and operate hydro-electric systems—the Tennessee Valley Authority and the Interior Department. This is apparent from letters sent the Secretary of War on October 15 by the President and by Interior Secretary Harold L. Ickes.

300,000 Kw. Involved

Mr. Ickes asked Secretary Stimson not to dispose of the four 5,000-kw. steam units installed at the Oklahoma Ordnance Works, 40-odd miles downstream from Pensacola Dam on the Grand River in northeastern Oklahoma, without consulting Interior. Pensacola currently is the key station of the three-dam Southwestern Power Administration, which will really become significant next February when generation begins at the Denison Dam on Texas' Red River and Norfork Dam on Arkansas' North Fork River.

The President also wrote Mr. Stimson concurring in Ickes' request and asking that he be furnished a list of such generating capacity now controlled by the Army.

The list is made up of 17 installations in 15 states, generating a total of about 300,000 kw., enough to firm up a large amount of federal hydro capacity which is now dependent on interconnection with regional private companies. Nine of the plants, totaling roughly 190,000 kw., are east of the Mississippi River, the other eight, totaling about 110,000 kw., are west of the River, with only two more than about 500 miles west.

130,000 Kw. in TVA Orbit

Six and possibly eight of the Eastern plants are geographically susceptible to assimilation into the TVA system. These six plants would give TVA 130,500 kw. of relatively new steam capacity after the war, presuming, of course, that the Army does not insist on keeping any of them in operation. The two other plants which conceivably could be tied into TVA's system total another 39,000 kw., although the larger of these quite possibly might be retained for ordnance purposes.

Southwestern Power Administration also is in geographical position to profit by the proposal, although it does not stand to get anywhere near so much steam capacity as could TVA. Pensacola Dam, largest unit of SPA, is flanked by 40,000 kw. of steam in two plants. Considerably father away, but still within the area of the Southwestern Power Pool, of which SPA is currently a part, are two more steam stations with 26,650 kw., a part of which may be withdrawn during the war. As now constituted, these four plants contain more capacity than does Pensacola, which has almost twice as much power as is scheduled, for the duration, for Denison and Norfork.

Two plants, totaling 32,500 kw., on the upper Mississippi River are so far removed from any existing federal system as not to be of appreciable significance for assimilation. They are close together, however, in a region highly susceptible to the organization of REA co-operatives. Another 10,000-kw. plant is located advantageously for possible tie-in with pending projects which have been deferred for the duration. Two others appear to be out of the question for tie-in with any existing or proposed federal system, although one of 7,500 kw. is in a region susceptible to public operation.

These 17 plants represent by no means all of the generating capacity now controlled by the Army. There are at least a dozen small installations, mostly diesel-powered, which range in size from 1,500 kw. on down. While plants of this size would be unsuitable for the purposes of a sizable private utility, they might serve the purposes of REA co-ops having the particular advantage of mobility.

In addition, the Army controls two amazingly large blocks of steam capacity, both admirably located for post-war assimilation into federal systems. Little more than their existence is generally known, and nothing concerning them may be printed.

Program Developing

At least one attempt has been made by a private company to purchase steam generators from an ordnance plant for post-war delivery. Its outcome remains obscure. It is, however, an entirely reasonable assumption that the Army will not relinquish title to any units without clearance from the administration.

How far this program will go is not yet clear, for it is still developing. Possibly units will be strategically relocated rather than assimilated in their existing power houses. Possibly the principle of "common carrier" energy transmission will be continued after the war in preference to federal construction of transmission lines. And one cannot help speculating on the possibility that the cost of the units will be charged off to the war and capacity made available free, or at trifling expense, to those federal agencies which can use it.

There is no known reason why the government may not transfer its property from one department to another. Since the administration is committed to the development of publicly owned power systems, what reason is there to believe that the Ickes program will not be carried out as fully as possible before any private buyer is afforded a look-in?

NEWS OF THE WEEK

Denies Power Shortage Exists in the Northwest

WPB official cites 200,000 kw. surplus generating capacity in refuting testimony of Rep. Angell of Oregon before Rivers and Harbors Committee — 232 projects approved, eight for power

A surplus of electric generating capacity conservatively estimated at 200,000 kw. exists today in the Northwest, a responsible WPB official told ELECTRICAL WORLD this week in reply to testimony by Rep. Homer D. Angell, Oregon Republican, that "we (the Northwest) are short of power at present."

Not only is there no shortage of power extant or in prospect for the Northwest, the WPB spokesman said, but a surplus of 300,000 kw. in the region is anticipated by the end of 1944. Proportionately to demand, the spokesman added, the existing surplus in the Northwest is greater than that in any other section of the United States. He explained that a local "tight" situation in Utah is only temporary."

Testifies Before Committee

Angell made and reiterated his statement in testimony before the House Rivers and Harbors committee last month when speaking in support of the Snake River and Umatilla Dam projects which the committee later approved. The committee approved 232 projects on which it has held hearings this session, rejecting two and referring the vote on a third. Eight projects of the $356,000,000 program contemplate installation of power generation facilities. The Enfield, Conn. project (ELECTRICAL WORLD, November 6, page 8) was rejected by the committee for the second time. Once previously, it had failed of approval by the House after being reported.

Rep. John E. Rankin, Mississippi Democrat, apparently confused the electric conservation campaign with a power shortage despite repeated avowals by Director J. A. Krug of the Office of War Utilities that the campaign is in no way necessitated by a shortage of generating capacity. Rankin told the committee that:

"We now have a scarcity of power in the TVA area. People in my district—domestic and commercial consumers—are being asked to cut down on their use of electricity as much as possible." (The Tennessee Valley Authority, serving Rankin's district, has been particularly active in promoting the electric conservation campaign, aimed at saving fuel, transportation, manpower and material.)

While the WPB spokesman declared that there is "nothing to change my opinion that we will end the war with a large surplus of power capacity in the Northwest," another WPB official added that:

"It does not seem likely that the aggregate of all new industrial loads in the Northwest would take any substantial portion of the surplus in view of the manpower situation in that area."

He added that some new capacity might be installed in local areas close to load centers where it might become needed to correct long-distance transmission difficulties, and explained that the fuel situation might make some additional hydro capacity necessary in the Northwest "strictly as a fuel conservation measure."

The Umatilla project, on the Columbia River west of Wallula, Wash., would open the river to all-season navigation

OPERATOR'S SILVER ANNIVERSARY—A quarter-century in Central Maine Power service is signalized above, where Alton Moody (second from left), substation and steam plant operator at Farmingdale, receives a pin from George Furbush, superintendent of stations. L. to r., James Cummings, Mr. Moody, Mr. Furbush, Robert Nelson and Nephi Perl

as far inland as Pasco, Wash., some 300 miles from the Pacific. The Snake River project would entail four dams between Pasco and Lewiston, Idaho, permitting navigation to Lewiston. Umatilla, regarded as the next step in Columbia River development, would have an ultimate installed capacity of 600,000 kw. The lower three Snake River dams would have 155,000 kw. of generating capacity.

The first installation at Umatilla is proposed to total 385,000 kw. in the form of eleven generators of 35,000 kw. capacity each.

Other power projects which received committee approval include the Savannah River below Augusta, Ga., and Clark's Hill Reservoir, $28,000,000; Apalachicola, Chattahoochee and Flint rivers, in Georgia and Florida, $6,500,000; Alabama and Coosa Rivers and tributories in Alabama and Georgia, $60,000,000; Neches and Angelina Rivers, Texas, $23,000,000; Guadaloupe River, Texas, $8,500,000; and Lock and Dam No. 2 on the Mississippi River between the Missouri River and Minneapolis. Vote on the $3,500,000 Sault Ste. Marie project in Michigan was delayed.

An omnibus bill containing the approved projects will be reported to the House next year asking approval only. Funds for the projects will have to be obtained later by separate action.

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Laboratory System Needs Free Enterprise

The engineering laboratory, now playing a vital role in the production of war materials, will play an equally prominent part in raising the post-war standard of living at home and abroad—if it is allowed to operate in a system of free enterprise.

This prediction was made last week by C. A. Powel, engineering executive of Westinghouse, in a speech before the Chicago section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers.

Mr. Powel pointed out that the laboratory system built up by individual companies could not have grown under any other type of system except free enterprise. "They are not maintained as a luxury; they must pay out or cease to exist," he asserted.

In reference to the post-war relations with other countries, Mr. Powel said that the United States must use its productive capacity and its wealth of technical talent to help restore foreign countries and increase the standard of living of their great middle classes. By so doing, he indicated, we will develop an even bigger market for the products of our factories and laboratories.

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Court Reverses SEC on Engineers Order

Divestment case remanded back to Commission

The United States Court of Appeals for the District of Columbia has reversed and remanded to the Securities and Exchange Commission an order requiring the Engineers Public Service Company to divest itself of all holdings except the Virginia Electric and Power Company.

Supports Some Points

The opinion, which supported numerous points made by SEC in its order, held that the final divestment order "should be complete in itself and cover all phases of the case," so it remanded the case for further proceedings by SEC.

Specifically, the court ordered SEC to study further the relationship between the Virginia company and a bus and street car system it operates in and around Richmond and Norfolk. SEC had ordered, in selecting V. E. & P. as the single integrated property to which Engineers might retain title, that the transportation operations be divested as not bearing a functional relationship to the electric business of V. E. & P. The court held the ruling which requires such functional relationship to be in error.

The court rejected a plea by Engineers that SEC, in ordering that V. E. & P. be retained by Engineers, had interfered with it in its right to select the system it chose to retain. The court affirmed the right of the holding company to choose which system it would retain, but ruled that such selection must be made within a reasonable time and that SEC may make such choice if it is not made by the holding company within that time.

Reject Unconstitutional Plea

Engineers' plea that the Holding Company Act is unconstitutional when considered in the light of evidence rejected by SEC was likewise rejected by the court which ruled that SEC is not allowed to pass upon constitutionality of the act, and that its refusal to admit the evidence does not preclude Engineers from presenting that evidence to a court which has jurisdiction over the constitutionality of the act.

High Court Upholds Niagara Cost Ruling

Refuses review of FPC order on utility "write-ups"

The Supreme Court refused last week to review a judgment of the U. S. Court of Appeals for the Second Circuit which upheld the action of the Federal Power Commission in requiring Niagara Falls Power Co. to write down its utility plant account the sum of $15,537,943. The utility contended that the order, issued June 9, 1942, and a subsequent order, dated September 1, 1942 (ELECTRICAL WORLD, June 27, 1942, page 62; November 7, 1942, page 20; June 26, 1943, page 60; August 21, 1943, page 77; October 30, 1943, page 66), violated its rights under a 50-year license granted by the commission on March 2, 1921.

Original Cost

In its original order the commission allowed $24,680,680 as the actual legitimate original cost of the company's project No. 16, a hydro-electric plant on the Niagara River, exclusive of certain items, and disallowed the $15,537,943 on the ground that this amount represented "write-ups" transferred to the company's accounts when it was organized by a consolidation of predecessor companies.

Niagara Falls Power Co. subsequently applied to the Court of Appeals for a hearing on its petition to set aside the FPC ruling and, when the court sustained the commission order, applied to the U. S. Supreme Court for a review of the decision.

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Canadian Wartime Board Combines Two Groups

The Wartime Prices and Trade Board has announced the amalgamation of two electrical administrations to form the new administration of electrical apparatus, equipment and supplies. The two former divisions were known as the electrical apparatus and machinery, electrical instruments administration and the electrical equipment and supplies administration. M. C. Lowe, administrator of electrical apparatus and machinery, electrical instruments, heads the amalgamation.

The amalgamation was brought about by the resignation of Arthur L. Brown, administrator of electrical equipment and supplies, who has been recalled by his firm, the Northern Electric Co., Ltd., to become chairman of the post-war planning committee.

Arkansas Utility Replies to FPC Order on Accounts

Charges commission with usurping powers of the state's regulatory bodies, exceeding its authority and violating Constitution in response to "show cause" order on $17,000,000 reclassification

Charges that the Federal Power Commission is usurping powers reserved to state regulatory agencies, is exceeding its own authority and is violating the Constitution were made recently by Arkansas Power & Light Co. in reply to a June 15, 1943, order of the commission requiring the company to "show cause" why certain accounts, approximating $17,000,000, should not be reclassified in accordance with the FPC's uniform system of accounts.

Answers on Excess Cost

The FPC claims that the $17,000,000 represents excess over original cost of the company's properties, the utility declared that "the properties acquired by the company were not acquired on the basis of amounts recorded in the plant accounts of predecessor companies," and that these properties "had a structural value at the time of acquisition which substantially exceeded the original cost of construction."

The company pointed out that it is not "waiving any objection to the jurisdiction of the Federal Power Commission" and denies that it has failed, as the commission order claimed, to comply in many respects with the FPC's uniform system of accounts. They added that the company had given the commission every possible assistance in locating records of the predecessor companies.

The charge that the FPC was violating states' rights was contained in the reference to the financing of the company. "Regulatory control of the company's general corporate and fundamental books of account is *excepted* in the grant of powers made to the commission in the Federal Power Act and expressly reserved to the state authority," the response said. "The company's activities and operations are subjected to comprehensive regulation, . . . as to rates, adequacy of service, issuance of securities, accounting, contracts with affiliated interests and every other aspect of its business which concerns the general public."

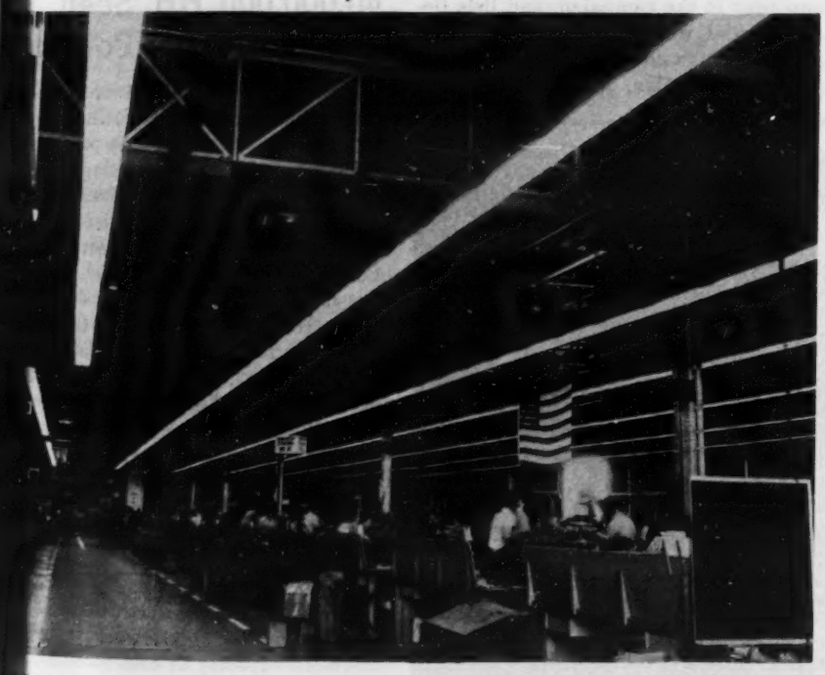
Charges that the FPC is further exceeding its authority are made on the grounds that the commission has included other properties. The response pointed out that a substantial portion of the company's assets comprises gas, motor coach, street railway and other non-electric properties which are not a part of electric plant and not subject to the commission's jurisdiction. In addition, a major part of the company's electric plant comprises facilties used for the generation of energy in intrastate commerce which, by the express provisions of the Federal Power Act, are excepted from the jurisdiction of the commission.

Deny Retroactive Application

The response further charges that the commission is illegal in attempting to make a retroactive application of its rules in requiring elimination from the books of the company of asset value lawfully established in such accounts long prior to the time the commission was granted any authority with respect to such accounts.

On the question of constitutionality, the response declares that a requirement that the company write out of its accounts certain amount would be without authority of law and would violate the constitution by taking the company's property without due process of law.

A further requirement that the company set forth in particular all the facts underlying its studies, which the company might introduce in evidence upon a hearing, is arbitrary, the response claimed, and does not afford an opportunity to be heard, and denies due process of law to the company.



OWING LINES OF LIGHT—The new engine repair building at McClellan Field, Army Base for the Air Service Command at Sacramento, is provided with more than 850 stinghouse lighting fixtures which supply 45 foot-candles of fluorescent illumination bench level; power for the lighting load is supplied from three-phase transformers from 150 to 300 kva.

Two Months Free Service Announced in Vancouver

Free electric service in November and December on Vancouver Island and the Kamloops area and in November in the lower mainland area was announced in a report released recently by the provincial public commission on operations of the British Columbia Electric Railway Co. The moratorium on electric bills will apply to households, civic street lighting, advertising, signs, office buildings and schools, but not to certain industrial users, the report said. Investigations of the rates and services of the company was made so that a rate could be established which is reasonable to the consumers and to the company. The moratorium was a temporary measure. The main report cannot be acted on now because conditions are not normal.

Appliance Conservation Drive Set for January

Sponsored by Edison Electric Institute, in co-operation with manufacturers, utilities, distributors and dealers, national program is designed to stimulate "Better Care — Less Repair" of appliances

The electric industry's "National Appliance Conservation Program," designed to keep an estimated 200,000,000 appliances functioning for the duration of the war, is scheduled to go into operation in January, 1944, and plans for the industry-wide promotion were outlined at a meeting of the Edison Electric Institute, which is sponsoring the program, at a meeting in New York City last week.

Utilities Spark Program

Co-operating with the E.E.I. in the program, which has for its slogan "Better Care—Less Repair," are manufacturers, utilities, distributors and dealers. According to C. E. Greenwood, commercial director of the institute, many utilities are doing an excellent local job in acquainting their customers, through advertising, displays, demonstrations and personal calls, with the need for keeping their appliances in good working order. These efforts are looked upon as doing only part of the job, however, as many localities are not organized to carry out this necessary activity.

Designed as a utility company program which will enlist the aid of retailers and consumers, the plan includes simple but effective promotional material for utility and dealer display floors and an appliance "Calendar Check List" containing a list of "Do's and Don'ts" for housewives to help them keep their appliances in good repair. It is not suggested that the housewife do her own repairs, but rather that she check on operation of her equipment at regular intervals and arrange for minor repairs when necessary to avoid breakdown. Millions of copies of the appliance "Calendar Check List" are expected to be distributed throughout the country through utility home service departments, at club meetings, by mail and through thousands of dealer stores. Manufacturers will tie in the campaign in their national advertising, utilities are urged to tie in national copy in their local newspaper advertising, and radio "plugs" for the drive will be provided by manufacturers on their national hook-ups.

E.E.I. has issued a plan book which outlines the part the utility company can play in the campaign, and lists tie-in material which is available at cost. For dealers, a four-page folder, briefly outlining the plan, will be distributed.

A display kit is also being readied which contains 23 pennants and window streamers with three different messages for utility-dealer displays and stores.

Includes Other Plans

The program, in addition, includes an activity designed to promote the redistribution of inactive appliances through such means as appliance exchanges, trading posts, swap plans, etc., and to augment present appliance repair programs, through the training of more appliance service personnel.

The campaign has received the blessing of J. A. Krug, director of the Office of War Utilities, and Arthur D. Whiteside, of the Office of Civilian Requirements. Chairman of the E.E.I. committee in charge of the program is M. R. Rodger, Middle West Service Co. Advisory committee comprises C. A. Collier, Georgia Power; R. D. Cutler, Hartford Electric Light; D. M. Dobard, Stone & Webster; T. B. Ferguson, Texas Power & Light; R. E. Fisher, Pacific Gas & Electric; C. E. Michel, Union Electric; G. W. Ousler, Duquesne Light; W. E. Parrott, Ebasco; H. M. Sawyer, American Gas & Electric; M. E. Skinner, Buffalo, Niagara & Eastern Power; Edwin Vennard, Middle West Service; G. E. Whitwell, Philadelphia Electric, and H. E. Young, Northern States Power.

CILCO "SAFETY WINDOW"—Commemorating the fact that Central Illinois Light Co. has had no accident since before Pearl Harbor, and that the company recently won first place in the National Safety Council's contest for class B utilities, this "safety window" display was put on show recently; Lawrence Lyman is safety director of the company

40,000,000 Hp. Seen as Canadian Potential

Canada's potential power resources are estimated to be approximately 40,000,000 hp., and judging by past experience the installed generating capacity would probably exceed that figure by 30 percent, Otto Holden, chief hydraulic engineer of the Ontario Hydro-Electric Power Commission, recently told the Royal Canadian Institute in Toronto.

Mr. Holden explained that this would mean that present recorded water power resources in the Dominion would ultimately permit of an installation of more than 50,000,000 hp.

Approximately half Canada's water power is located roughly in Quebec, Ontario and eastern Manitoba in close association with great mineral deposits and vast forests, he said.

He stated that 98 percent of Canada's electrical energy is derived from falling water and that this Dominion had an installed capacity of over 9,250,000 hp.

Mr. Holden, who has been with the Ontario Hydro-Electric Commission since graduating from the University of Toronto in 1913, is president of the institute for the coming year.

September Revenues Up; Quarter Taxes Increase

Federal Power Commission report also reveals that operating expenses were up 15 percent for September, compared to last year — Quarterly dividends up 14.5 percent — Rise in excess profits tax

Electric operating revenues of the rger privately managed electric utili-es in the United States in September, 43, were $253,071,000, as compared $232,265,000 in September, 1942, an crease of 9.0 percent, according to a port issued last week by the Federal ower Commission. At the same time e commission reported that total xes charged to electric operations of ch companies in the third quarter ere $162,738,000, as compared to 56,197,000 in the corresponding quar-r of 1942, an increase of 4.2 percent.

The Revenue Report

The September report revealed that venues from sales to ultimate con-mers were up 8.6 percent to $227,-6,000 and electric operating revenue eductions (including operating ex-enses, depreciation and taxes) were 95,566,000, or 11.2 percent over those September, 1942.

Net electric operating revenues in-reased 2.0 percent to $57,505,000, and ross income, including other utility perating income, increased 1.2 per-nt to $65,994,000. Income deductions creased 1.1 percent to $25,531,000. et income in September, 1943, was 0,463,000, an increase of 1.4 percent er the net for September, 1942.

Revenues by classes of service in ptember, 1943, compared with the me month of 1942 were as follows: dustrial, an increase of 16.6 percent; sidential, an increase of 5.0 percent; mmercial, a fractional decrease. Op-ating expenses in September, 1943, re $115,609,000, or 15.0 percent eater than those of the same month t year. Depreciation charges were creased 4.4 percent to $24,392,000 d taxes increased 5.2 percent to $54,-3,000.

In the report on results for the third arter of 1943 the commission reported at total dividends for the period nounted to $95,624,000, as compared th $83,513,000 in the same period of 42, an increase of 14.5 percent. Sal-ies and wages in the same period in-eased 6.0 percent to $126,916,000, om $119,674,000 in the third quarter 1942. The statement points out that reporting salaries and wages charged electric operations certain of the respondents include salaries and wages of other utility departments and others do not include charges to clearing accounts.

In the federal tax bracket excess profits taxes increased 27.9 percent to $44,801,000, income taxes were down 8.0 percent to $45,372,000 and other federal taxes increased 5.6 percent to $16,226,000, bringing the total federal taxes for the third quarter to $106,399,000, an increase of 6.7 percent over the total of $99,685,000 in the third quarter of 1942. State and local taxes decreased 0.3 percent to $56,339,000, under the $56,512,000 in the third three months of 1942.

Dividends on preferred stock in the third quarter of 1943 were $29,470,000, or 6.0 above the $27,800,000 figure for 1942, and common stock dividends increased 18.7 percent to $66,154,000 from the 1942 figures of $55,713,000.

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Abe Fortas Off to War

Former Interior Under Secretary Abe Fortas went to war as a "Boot" Seaman last week after resigning as head of a mission bound for the Middle East to survey petroleum resources.

The one-time director of the Public Utilities Division of the Securities and Exchange Commission had been inducted at his own request several weeks previously, cutting short a deferment granted him last spring at the request of the President and Interior Secretary Harold L. Ickes. He was immediately furloughed to serve with the mission sponsored by the Petroleum Reserves Corporation, one of Ickes' organizations under his duties as Petroleum Administrator for War. Departure of the mission was delayed, leading Fortas to ask for immediate duty as an apprentice seaman.

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Jones Takes Over Cisler Post at OWU

Chandler W. Jones, formerly deupty chief of the materials control branch of the Office of War Utilities' Power Division, has been named chief of the Power Division's equipment production branch, replacing Walker Cisler. Jones was affiliated with the New England Power Service Co. of the New England Power Association before joining OWU's predecessor, the Power Division of the War Production Board.

Lester L. Bosch, formerly chief of the turbine section of the equipment production branch, has been named deputy chief of the equipment production branch. Bosch, formerly with the Columbia Engineering Co., a subsidiary of the Cincinnati Gas & Electric Co., has been succeeded as chief of the turbine section by A. S. Griswold, formerly of the Detroit Edison Co.

WAR LIGHTING CONFERENCE—Nearly 150 lighting service men and engineers attended a recent four-day wartime lighting course held at General Electric's Nela Park, Cleveland. They represented utilities, distributors, fixture manufacturers and users of lighting equipment, and included in the group were 32 weavers of the "gold bomber" lapel pin awarded lighting men responsible for smashing lighting bottlenecks in war plants

P. P. & L. System Sought by PUD

In one of the most ambitious purchase plans yet evolved by a PUD in Washington or Oregon, the Hood River, Oregon, People's Utility District last week announced that an election will be held on January 7 to vote on a proposed issue of $175,000,000 in revenue bonds to finance the purchase of the Pacific Power & Light Co., and possibly Northwestern Electric Co. and Portland General Electric Co. in addition.

The Hood River PUD lies in rural Hood River County and the population of the district is about 8,000. The board's engineer is R. W. Beck, one-time Seattle City Light and Bonneville Power Administration employee, who handled the engineering details in power acquisitions of Cascade Locks, Oregon; the Skamania county, Gray's Harbor and Pacific county PUDs in Washington; the Consumers Public Power District of Nebraska, and the city of Key West, Fla. Financial adviser for the district in its plan is Guy C. Meyers, New York City broker, who has been active in PUD financing activities for a number of years. His agreement with the PUD would give him 2½ percent "commission" on sale of the first $4,000,000 in bonds, 1½ percent on the next $10,000,000 and 1 percent on the remaining $161,000,000. If all were sold his commission would be $1,411,000.

The Hood River district's board of directors, in a full-page announcement of the plan, said that it would use no more money than needed to put the Hood River PUD in business. Presumably, any plan to acquire Pacific Power & Light's $43,000,000 business would entail the co-operation of a group of PUDs in Washington. Paul B. McKee, president of Pacific Power & Light, called the proposal "too fantastic to merit serious consideration."

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Puerto Rico Turbine Going to Monterey

The Office of War Utilities has authorized the installation of a 7,500-kw. steam turbine, originally manufactured for the Puerto Rico Railway Light & Power Co., in the Monterey, Mexico, plant of the Monterey Railway Light & Power Co. The unit, which is complete, will be installed as soon as possible.

The unit was released from its original Puerto Rico assignment by Gen. Philip B. Fleming, Federal Works Administrator, when FWA expropriated the P.R.R.L. & P. property late last year. Fleming explained then that integration of the company system with the hydro system of the Puerto Rico Water Resources Authority made it unnecessary to add to the fuel-fired capacity of the island.

Installation at Monterey will raise installed capacity at that city to 23,500 kw. OWU officials said the system has been returned to normal after a breakdown of its 10,000-kw. unit last summer. Another generator for an industrial plant at Monterey is being considered by OWU, it was learned.

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Anderson Ranch OK'd

At the request of the War Food Administration and the Bureau of Reclamation, WPB has revoked its stop construction order against the Anderson Ranch irrigation project on the Boise River in Idaho. The $9,200,000 project to irrigate lands in the Boise River valley has no power-generating units scheduled.

MEETINGS

Previously Listed

American Society of Mechanical Engineers—Annual meeting, Pennsylvania Hotel, New York, N. Y., November 29-December 3. Ernest Hartford, executive assistant secretary, 29 West 39th St., New York, N. Y.

Petroleum Electric Power Association — Annual meeting, Baker Hotel, Dallas, Texas, December 1-2. L. B. Blalock, secretary-treasurer, Dallas, Texas.

American Society of Agricultural Engineers—Fall meeting, LaSalle Hotel, Chicago, Ill., December 6-8. Raymond Olney, secretary, St. Joseph, Mich.

19th Exposition of Chemical Industries—Madison Square Garden, New York, N. Y., December 6-11. C. F. Roth, manager, Exposition of Chemical Industries, Grand Central Palace, New York, N. Y.

National Association of Manufacturers—2nd War Congress of American Industry, Waldorf Astoria Hotel, New York, N. Y., December 8-10. J. M. Boyd, secretary, 14 W. 49th Street, New York, N. Y.

American Standards Association — Annual meeting, New York, N. Y., December 10. P. G. Agnew, secretary, 29 West 39th Street, New York, N. Y.

Pennsylvania Electric Association—Meter Committee, Benjamin Franklin Hotel, Philadelphia, Pa., December 10. Bradley M. Smith, chairman, P. O. Box 860, Erie, Pa.

Technical Valuation Society — Annual forum and business meeting, Building Trades Club, 2 Park Ave., New York, N. Y., December 11. W. C. Fisher, chairman, Room 516, 4 Irving Place, New York, N. Y.

American Society of Civil Engineers — Annual meeting, Engineering Societies Building, New York, N. Y., January 19-21. George T. Seabury, secretary, 33 West 39th St., New York, N. Y.

American Institute of Electrical Engineers—National technical meeting, Engineering Societies Building, New York, N. Y., January 24-28. H. H. Henline, secretary, 33 West 39th Street, New York, N. Y.

Sales Executives' Conference — Netherland Plaza Hotel, Cincinnati, Ohio, February 3-4. H. E. Dexter, secretary-treasurer, 50 Market Street, Poughkeepsie, N. Y.

Keeping Up With Conservation

THE ASSOCIATION OF AMERICAN RAILROADS is delivering reproductions of the flying eagle symbol adopted by the inter-industry committee as the official conservation campaign symbol. Member companies will post the symbol and use it wherever possible in correspondence, advertisements and the like.

THE ARMY, NAVY and the Public Buildings Administration have issued orders directing that the standards of the overall conservation campaign and its component industry campaigns be adhered to wherever possible. Hall lighting has been cut down in several government buildings in Washington, where PBA is expected to extend further the possible conservation practices.

EDITORIAL COLUMNS OF THE CINCINNATI ENQUIRER on October 31 contained a tribute to the electric industry and its voluntary conservation campaign. Pointing out that "the power companies of the nation have done a remarkable job of meeting the demands for current . . . ," the editorial adds that:

"It is strange to see power companies spend their advertising dollars in an effort to discourage consumption of electric current. But by the very act, local companies, whose operations are dependent initially upon consumption of coal, are proving again to the community their patriotic devotion to the cause of freedom."

THE MERCHANTS' ASSOCIATION OF INDIANAPOLIS is pushing a lighting curtailment program which would eliminate all daytime lighting of outdoor signs, show-windows and marquees. Outdoor signs could shine nightly from dark until 9 P.M. on Mondays and from 7 until 9 P.M. other days. Show-windows and marquees could be lighted on Mondays and Saturdays from dark until 9 P.M. and on other evenings from 7 until 9 P.M.

BUFFALO, N. Y., RESIDENTS got first-hand knowledge of the coal shortage last week when they were forced to get physicians' prescriptions for coal in half-ton lots. In the words of the Buffalo Fuel Merchants' Association, as quoted by the Buffalo Courier-Express, "We had to turn down a lot of applications in whose cases we learned that gas could be burned to maintain some heat in the homes." By thus encouraging the use of gas ovens for space heating, the coal shortage threw a real jolt into the Buffalo gas conservation campaign, part of the overall campaign.

Output Up Again For 18.7% Increase

The output curve again reached a new high during the week ended November 20, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry during the week totaled 4,513,299,000 kw.-hr., compared to 4,482,665,000 kw.-hr. the week previous. Figures for the latest week represent an increase of 18.9 percent over the 3,795,361,000 kw.-hr. distributed during the corresponding week in 1942.

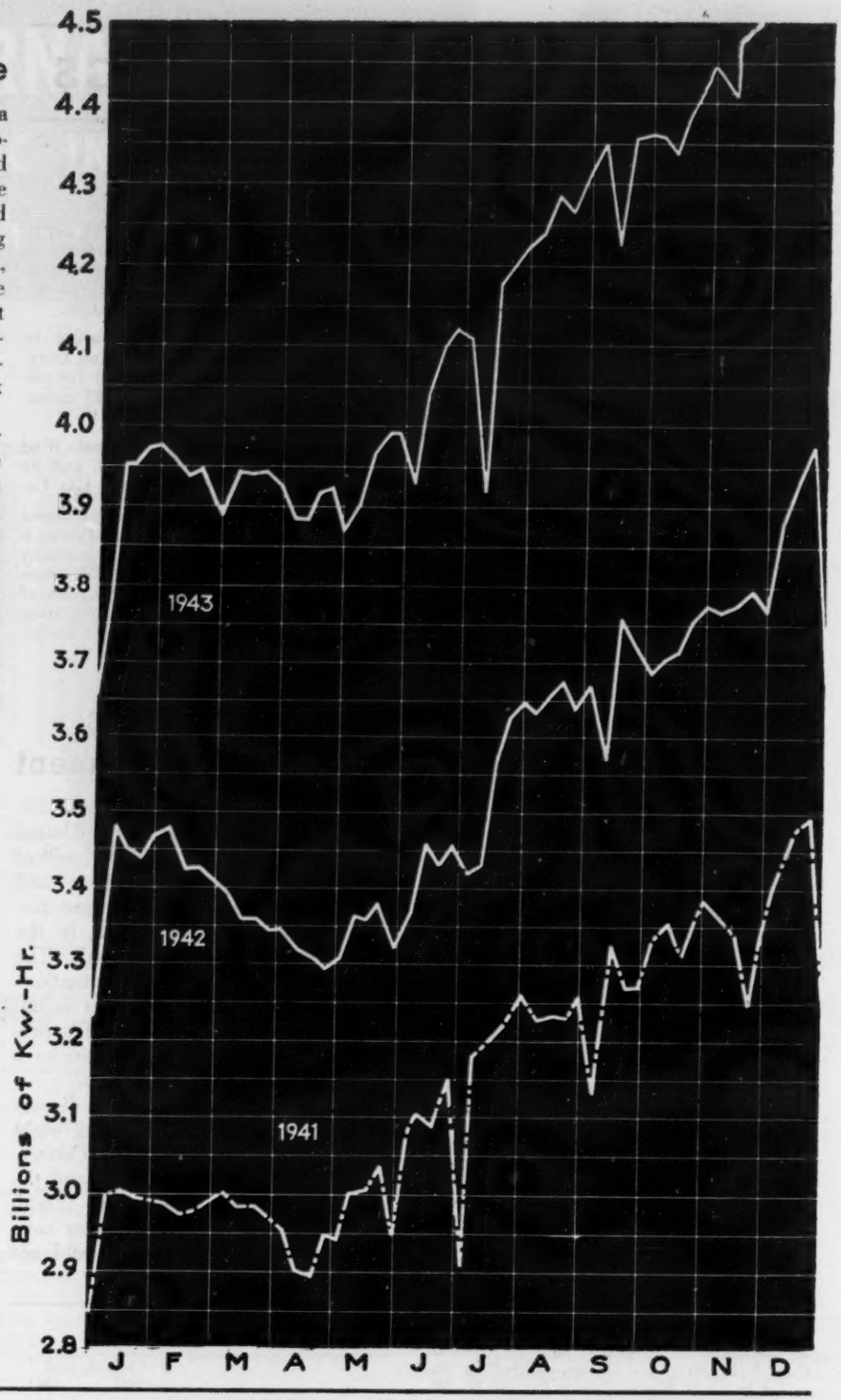
Three of the country's seven major geographic regions contributed to the rise during the latest week. The Pacific Coast region held first place again with a 36.9 percent increase over the 1942 week; the Mid-Atlantic region with a 20.5 percent gain, was in second place, and the Southern States, with a 19.9 percent increase, were in third place. New England and the West Central States fought it out for cellar position among the region's standings, with 7.7 percent and 7.9 percent increases respectively. The Pacific Coast region made the largest gain over the 1942 week, compared to the week previous, in the listings.

Weekly Output, Millions Kw.-Hr.

1943		1942		1941	
Nov. 20	4,513	Nov. 21	3,795	Nov. 22	3,247
Nov. 13	4,482	Nov. 14	3,776	Nov. 15	3,348
Nov. 6	4,414	Nov. 7	3,762	Nov. 8	3,368
Oct. 30	4,452	Oct. 31	3,775	Nov. 1	3,380
Oct. 23	4,415	Oct. 24	3,752	Oct. 25	3,341
Oct. 16	4,382	Oct. 17	3,717	Oct. 18	3,313
Oct. 9	4,342	Oct. 10	3,702	Oct. 11	3,355
Oct. 2	4,359	Oct. 3	3,683	Oct. 4	3,330
Sept. 25	4,360	Sept. 26	3,720	Sept. 27	3,273
Sept. 18	4,358	Sept. 19	3,757	Sept. 20	3,273

Percent Change from Previous Year

	Week Ending		
	Nov. 20	Nov. 13	Nov. 6
New England	+ 7.7	+ 8.3	+ 8.2
Mid-Atlantic	+20.5	+19.0	+18.1
Central Industrial	+14.1	+15.1	+12.7
West Central	+ 7.9	+10.5	+ 8.7
Southern States	+19.9	+20.3	+20.4
Rocky Mountain	+15.5	+14.8	+15.5
Pacific Coast	+36.9	+33.3	+29.7
Total United States	+18.9	+18.7	+17.3



San Antonio vs. LCRA Set for January

The Texas Supreme Court has set for hearing on January 5, 1944, an attempt to determine which of two district courts has jurisdiction in the dispute between the city of San Antonio and the Lower Colorado River Authority over operation of the Comal power plant at New Braunfels.

The court granted the city's request for leave to file a petition for mandamus to bring the case from the court of District Judge M. C. Jeffery of Comal County.

The Comal power plant belonged to the San Antonio Public Service Co., which the city purchased, then leased to the Guadalupe-Blanco River Authority. The latter agency assigned its lease to the LCRA.

Trustees of the city electric system attempted to have the lease declared invalid by a court, but its suit was denied on the ground that the trustees were without authority to question the transaction. The city then obtained an injunction from District Judge John Onion of San Antonio. Judge Jeffrey in turn enjoined the city from prosecuting its suit.

To remove the conflict in jurisdiction, the state Supreme Court agreed to consider the mandamus request, unless the question of jurisdiction is decided amicably on or before the fifth day of January, 1944.

SEC DECISIONS-HEARINGS

The Securities and Exchange Commission, in a series of orders and opinions issued last week affecting electric utility companies:

APPROVED A VOLUNTARY PLAN, filed by North Continent Utilities Corp., looking toward the liquidation and dissolution of the holding company under the Holding Company Act. The plan provides for the sale of all North Continent's interests in five utility subsidiaries and three non-utility subsidiaries. Utility subsidiary interest include the Elk River Power & Light Co., the Great Northern Gas Co., Ltd., the New Mexico Public Service Co., the Highland Utilities Co. and the Southern Arizona Public Service Co. Proceeds from the sale of securities and other assets will be used first to retire the bonds of North Continent and the remaining assets will be distributed to holders of North Continent's common stock.

APPROVED THE SALE BY Cities Service Power & Light Co., through underwriters, of its entire common stock holdings in Public Service Co. of Colorado, amounting to 875,000 shares of $20 par value stock, with an aggregate par value of $17,500,000, following a proposed recapitalization. Preliminary to the sale, Cities Service Power & Light proposes to exchange all its $4,023,500 investment in the operating company's preferred stocks for an equal amount of common stock, bring Power & Light's holdings of the present $100 par common to $27,013,500. Of this amount, $9,513,500 will be returned to Colorado as a contribution of common stock. Following this transaction, Power & Light's investment in Colorado would be changed into 875,000 shares of $20 par value common. Commissioner Robert E. Healy dissented from the majority opinion on the grounds that all of the outstanding common stock of Public Service of Colorado had been obtained by Cities Service Power & Light at "no cost, in fact, at less than cost" and that it was this stock which the majority (of the commission) now permits to be sold to the public for a sum "which may possibly be somewhere between $22,000,000 and $25,000,000. He also declared that "on that stock which ultimately cost Cities Service nothing there were paid out in cash dividends $47,133,326 from 1910 to 1943."

WITHDREW THE EXEMPTION OF RULE U-44 as affecting the proposed sale by General Gas & Electric Co. of its controlling interest in Tide Water Power Co. to W. W. Bell "for a total consideration of $55,000." Under paragraph (b) (2) of rule U-44 of the Holding Company Act, sales of less than $100,000 would not have to be brought before the commission for consideration. In this case, however, the commission said, the common stock proposed to be sold by General Gas carries 82.9 percent of the voting power of Tide Water and represents practical control of a $14,000,000 concern. W. W. Bell is an officer and director of Northeastern Water & Electric Corp.

RELEASED JURISDICTION OVER FEES and expenses to be paid by Southern Colorado Power Co. in connection with the issuance and sale of $5,500,000 of its 3½ percent first mortgage bonds, due 1968.

Hearings Scheduled

NOVEMBER 29: Hearing on recent application of American & Foreign Power Co., subsidiary of Electric Bond & Share Co., to retire a past due note held by the parent in the principal amount of $35,000,000.

NOVEMBER 30: Reconvened hearing in the matter of the proposal of United Corp. to spend not more than $2,500,000 for the purchase through brokers of its $3 cumulative preference stock.

DECEMBER 1: Hearing on proposals filed by American Light & Traction Co. and its subsidiary, Michigan Consolidated Gas Co.

DECEMBER 14: Hearing on a proposed stock reclassification of American Power & Light Co. under which the holding company would reclassify all its outstanding common and preferred stocks into a single class of capital stock, with a view to eliminating dividend arrearages on its preferred stocks.

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Court Upholds SEC on U.G.I. Divestment

Two orders of the Securities and Exchange Commission requiring United Gas Improvement Co. to divest itself of nine public utility corporations and nine non-utility corporations were sustained unanimously last week in the Third Circuit Court of Appeals. The court, in rejecting U.G.I.'s contentions that the Holding Company Act is unstitutional, also upheld the SEC's procedure of determing what constitutes a "single integrated utility system."

The commission ordered the divestiture of the utilities, comprising eight companies in the so-called "Connecticut group," on May 7, 1942, and the non-utilities, comprising the "mid-Western group," of ice and water companies on July 30, 1941, and did not affect at that time the holding company's interest in Philadelphia Electric Co. and Public Service Corp. of New Jersey.

The court's decision does not affect the transactions covered under the company's voluntary plan of partial liquidation, which was approved by the commission.

Another step in the voluntary liquidation plan will be filed by U.G.I. in the near future, involving distribution to its common-stockholders of U.G.I.'s common stock holdings in Delaware Power & Light Co., into which Eastern Shore Public Service Co. of Delaware was recently merged with commission approval.

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Utility Reports

	Net Income 1943	1942
*American Water Works & Elec. and subs.	$3,667,570	$4,047,808
*Arkansas Power & Light	1,514,757	1,752,682
*California Elec. Power and sub.	1,099,443	784,928
*Columbus & So. Ohio Elec.	3,215,732	3,641,584
*Dallas Power & Light	1,521,181	1,487,586
*El Paso Electric (Texas)	606,719	541,562
*Gulf States Utilities	2,040,228	1,721,888
*Kansas City Pwr. & Lt.	2,877,007	2,969,996
*Minnesota Power & Light	2,237,451	1,236,380
*Niagara Hudson Power and subs.	6,444,934	7,040,352
*Northwestern Electric	717,817	588,489
*Pacific Gas & Electric	22,577,525	21,597,015
*Puget Sound Power & Light and subs.	4,398,344	2,551,929
*Savannah Elec. & Power	261,688	163,898
*Utah Power & Light and subs.	2,149,669	1,883,048

*Twelve months ended September 30.

Tri-Counties Abandon PUD Condemnation

PUD officials of Thurston, Lewis and Cowlitz counties in Washington have abandoned attempts to acquire the properties of the Puget Sound Power & Light Co. through piecemeal condemnation. The three districts brought condemnation actions in the Federal District Court nearly three years ago known as the Tri-County condemnation case.

On May 10, 1942, a jury acting on the consolidated case returned a verdict placing the total price that must be paid by the three counties at $7,600,000. During the course of the trial the highest price set by the three districts as their idea of the total value was $5,064,500.

Now, in formal resolutions recently passed, the Lewis and Thurston PUD's state that they are abandoning the proceedings "in the public interest," while the Cowlitz district states that "it is in the public interest (to abandon the suits) in view of the decisions of the two other districts."

Taxpayers, however, still have a $12,500 budget to pay next year's expenses, on which they will get no return.

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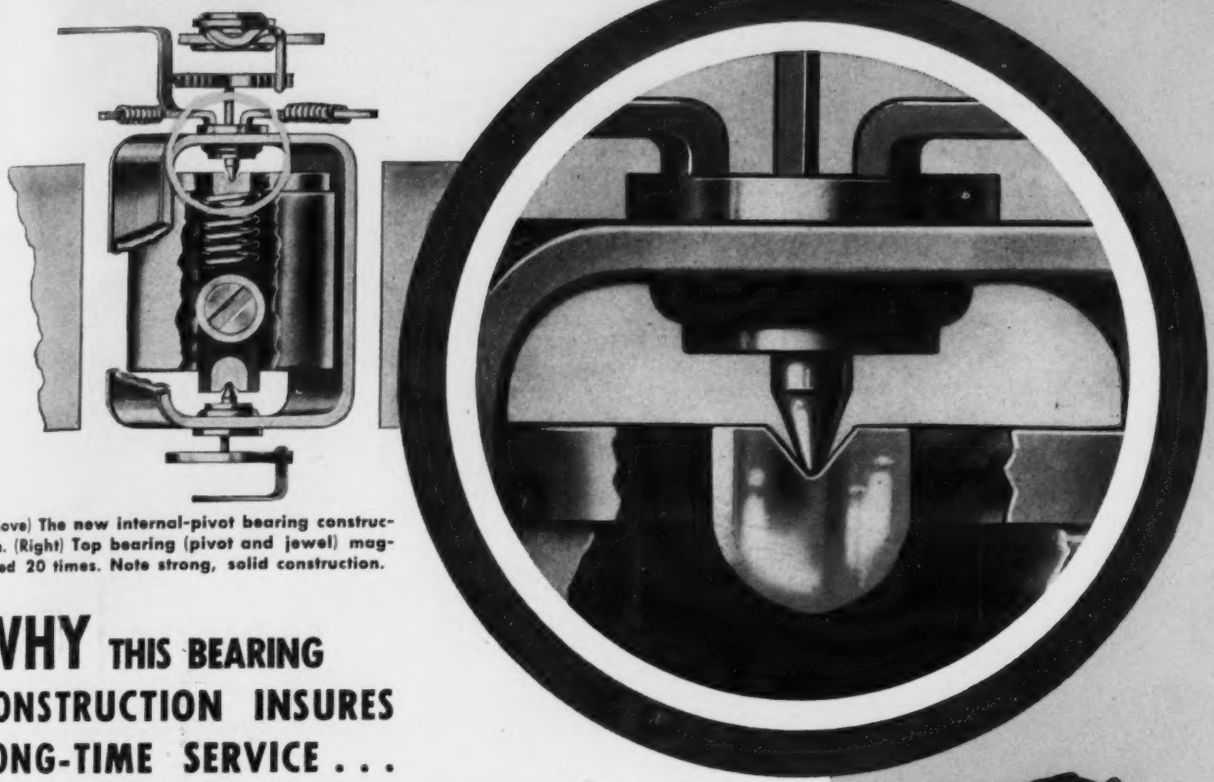
Senate OK's McConnaughey to SEC

Nomination of Robert K. McConnaughey for membership on the Securities and Exchange Commission has been confirmed by the Senate. McConnaughey was appointed recently by President Roosevelt to succeed Edward Burke, Jr., who resigned (ELECTRICAL WORLD, October 30, page 62).

New INTERNAL-PIVOT ELECTRIC INSTRUMENTS

2½-inch - - - 1 inch deep

For radio and other communications service; d-c voltmeters, ammeters, milliammeters, microammeters, and radio-frequency ammeters and milliammeters (a-c thermocouple type). Cases are brass or molded Textolite.



(Above) The new internal-pivot bearing construction. (Right) Top bearing (pivot and jewel) magnified 20 times. Note strong, solid construction.

WHY THIS BEARING CONSTRUCTION INSURES LONG-TIME SERVICE . . .

IN THESE new G-E instruments, the pivots are solidly mounted on the *inside* of the armature shell instead of being cemented to the outside of the armature winding. The result is a rigid construction that helps to maintain accurate alignment.

The steel pivots, highly polished, are of the aircraft type, larger than normal. This means less stress on the bearing surfaces and a construction that will stand rough treatment and shock.

The pivots rotate in low-friction, highly polished, glass vee jewels—one mounted rigidly in the top of the frame-and-core assembly, and the other mounted in a movable lower jewel sleeve located in the soft-iron core.

This combination—accurately formed, hard-glass jewels and large-radius steel pivots—provides a co-ordinated bearing that has proved, by field tests, to be excellent from the standpoint of long life and ability to withstand vibration.

Thin, Strong, Accurate Instruments

1. *Thinness* is obtained by solidly mounting the pivots on the inside of the armature shell. Most instruments are approximately one inch deep.
2. *Strength* is obtained by short, solidly mounted, large-radius pivots and the extra-strong over-all case.
3. *Sustained Accuracy* is insured by the featherweight moving element, combined with high torque and permanent alignment of all parts.

For ratings, prices, and dimensions, ask our nearest office for Bulletin GEA-4064, which covers instruments for use in radio and communications equipment; or Bulletin GEA-4117, which describes those suitable for naval aircraft. *General Electric Co., Schenectady, N. Y.*

D-c voltmeters, volt-ammeters and ammeters are specially designed to measure voltage and current in battery and battery-charging circuits on naval aircraft. They meet applicable Navy specifications.

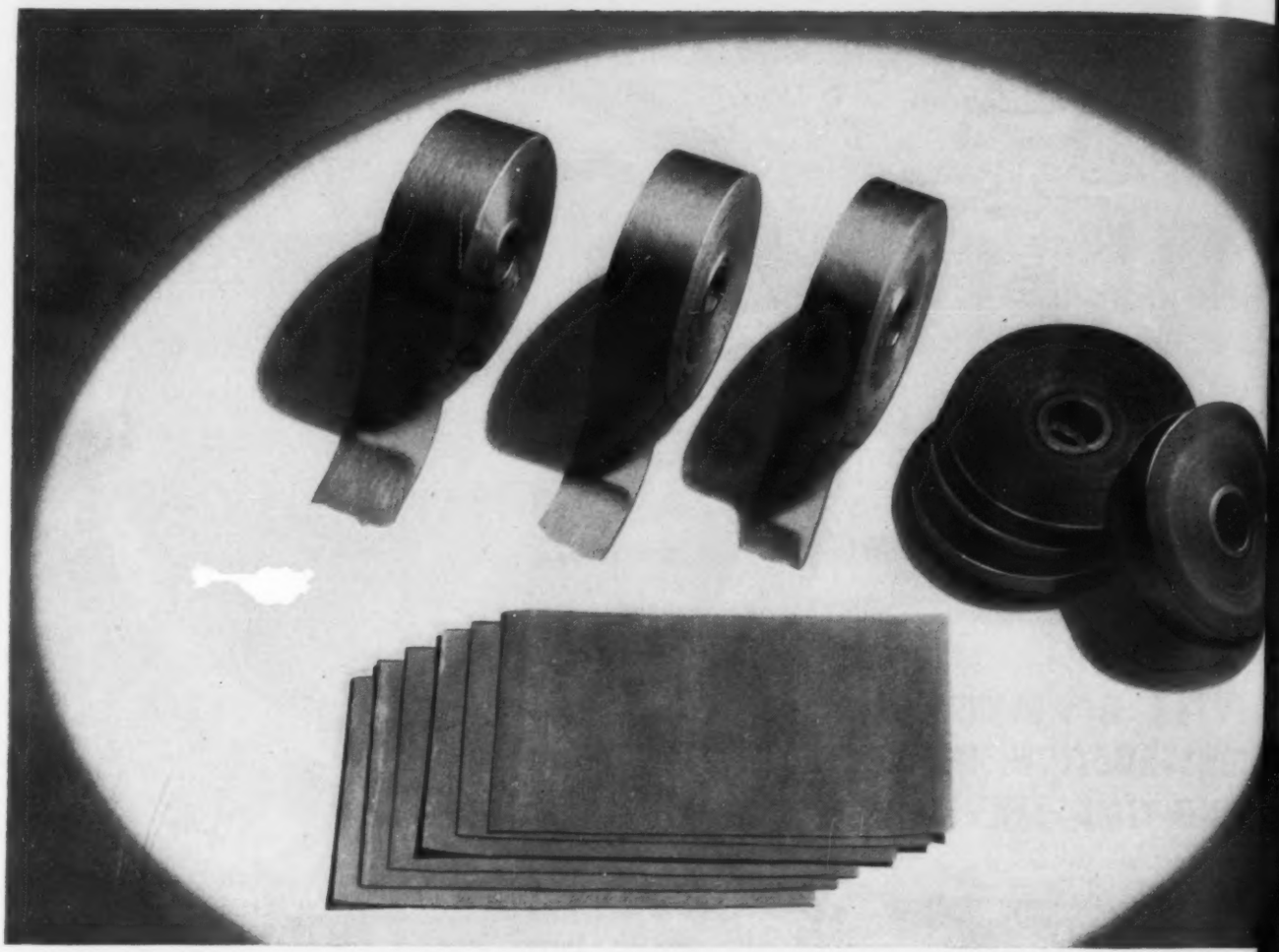
SMALL PANEL INSTRUMENTS

GENERAL ELECTRIC

802-44-6200

Announcing

A NEW Dielectric Material for Capacitors-



LECTROFILM—a new product developed by the General Electric Laboratories—is a synthetic dielectric made from raw materials that are available in large quantities in the United States.

Capacitor manufacturers will find it ideal for use in most radio-frequency-blocking and by-pass, fixed capacitors that for years have been built with mica. These capacitors are of the type used in communications and other electronic equipment.

Lectrofilm has a greater combination of desirable mechanical and electrical properties than any other one capacitor dielectric material. It is available in both rolls and sheets, and can be used in present capacitor production lines, little or no change being required in equip or manufacturing methods. Its strength flexibility make it well suited to handlin automatic means.

Best of all, lectrofilm has uniform chara istics; it requires little if any grading, sor or inspection. Therefore, it is economic well as easy to use, and when properly ap will cut down the number of finished capac that are rejected in test. Users of lectr can expect increased capacitor produ with present facilities without any increa man-hours.

Lectrofilm is available for use by manufact making capacitors for the armed forces.

LECTROFILM

TYPICAL CHARACTERISTICS

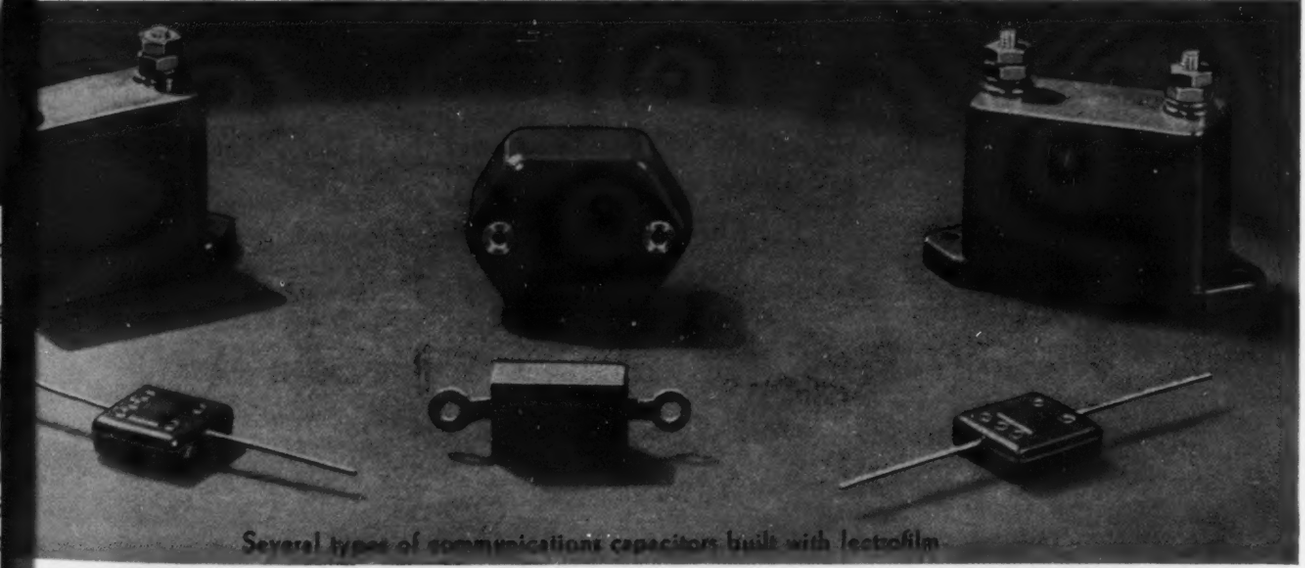
	Lectrofilm in Rolls, No. 2681	Lectrofilm in Sheets, No. 2682
D-c breakdown strength	1900 volts per mil (Two or more thicknesses)	2500 volts per mil
Dielectric constant	4.0 or more	5.5 or more
Tensile strength	Equal to Kraft capacitor paper	Equal to Kraft capacitor paper
ower factor at 1,000,000 cles* Per cent at 25 C Per cent at 100 C	3.5 or less 1.75 or less	2 or less 1 or less
Capacitance temperature coefficient, per cent per degree C*	0.05 to 0.15	0.05 to 0.15
Maximum recommended operating temperature	100 C	125 C

se characteristics, determined by actual test results on capacitors built with lectro- will depend on the type of capacitor construction.

For information on

- **sizes**
- **thicknesses**
- **weights**
- **additional characteristics**

...write for Bulletin GEP-217A. Address: Section 16-216, General Electric Company, Pittsfield, Mass.



Several types of communications capacitors built with lectrofilm

very week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds

GENERAL ELECTRIC

407-69-570M

These are the BENEFITS of a CLOSELY HELD VOLTAGE SUPPLY

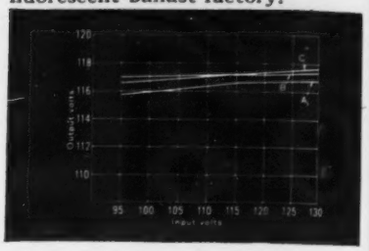
Better performance, greater reliability, and longer life of electronic devices

Protection of delicate instruments and machines, precision tools, and electronic tubes against sudden overvoltages

More accurate test results, fewer rejects

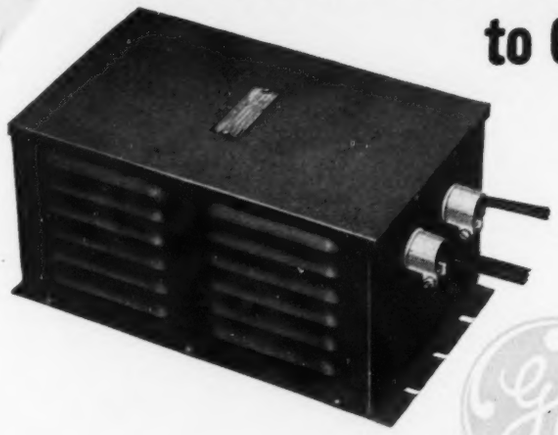
And manufacturers—don't forget:
A product's salability can be increased when voltage stabilization is a built-in feature.

EXTREMELY CLOSE VOLTAGE REGULATION, so essential to speedy, accurate production-line testing, is automatically maintained by a 500-volt-ampere G-E stabilizer on a test bench in a fluorescent-ballast factory.



▲ **LOOK AT THIS PERFORMANCE**—Practically constant voltage for several typical conditions (A—Open circuit; B—Full load, unity power factor; C—Full load, 0.8 power factor lagging). Stabilizing action practically instantaneous, taking place in less than three cycles.

...and Here's the Way to Get It



IMPROVES THE PERFORMANCE OF EQUIPMENT LIKE THIS:

Radio transmitters and testing equipment
Photoelectric equipment and other electronic-tube apparatus
Motion-picture projectors and sound equipment
Telephone apparatus
X-ray machines
Precision photographic equipment and photometers
Color comparators
Calibration of meters, instruments, relays
Laboratory precision processes and testing equipment

FOR DETAILS on this stabilizer's unique circuit, write for Bulletin GEA-3634. *General Electric Company, Schenectady, N. Y.*

VOLTAGE STABILIZERS

GENERAL ELECTRIC

The best investment in the world is in this country's future—BUY WAR BONDS

HOW DESIGN... CONSTRUCT OPERATE MAINTAIN

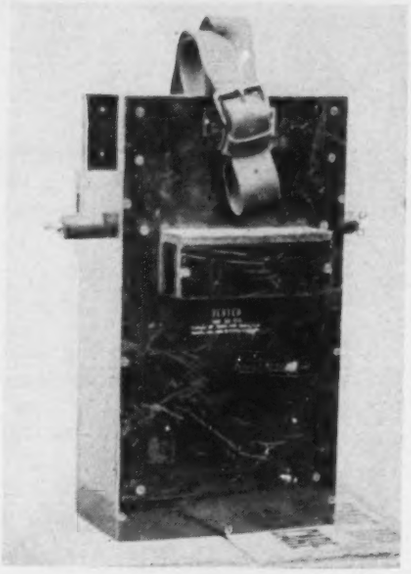
Gas Tube Phasing Device Range 2.4-22 Kv.

By ROY F. STUART
Pacific Gas & Electric Company,
Oakland, Calif.

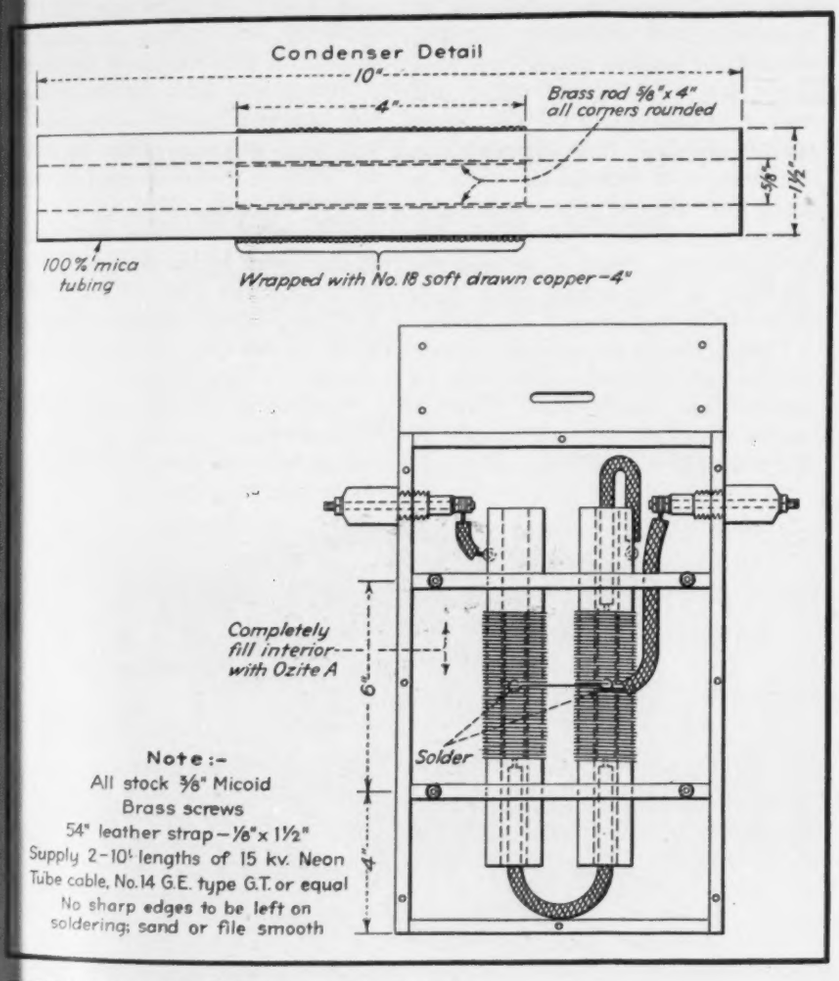
Use of a condenser in conjunction with a gas-filled tube for voltage detection is not a new application, but voltage range of commercial devices left something to be desired, in the experience of the author. Investigation of the subject and a proper choice of materials has led to the development of the phasing device shown in the accompanying illustration, which has met a need and proved entirely satisfactory in the East Bay division of the Pacific Gas & Electric Company.

It consists essentially of two specially constructed condensers in series and in turn in series with a standard gas-filled glow tube. Detachable test leads handled with hot sticks connect the device to the circuit to be tested. The experimental model was submitted to the company's bureau of tests and successfully withstood a potential of 46 kv. for one minute. At the same time a satisfactory indication is obtained on 2.4 kv. Normal working range of the device is considered as 2.4 kv. to 22 kv. It is used on overhead 12-kv. and 22-kv. lines and on the 4-kv. underground.

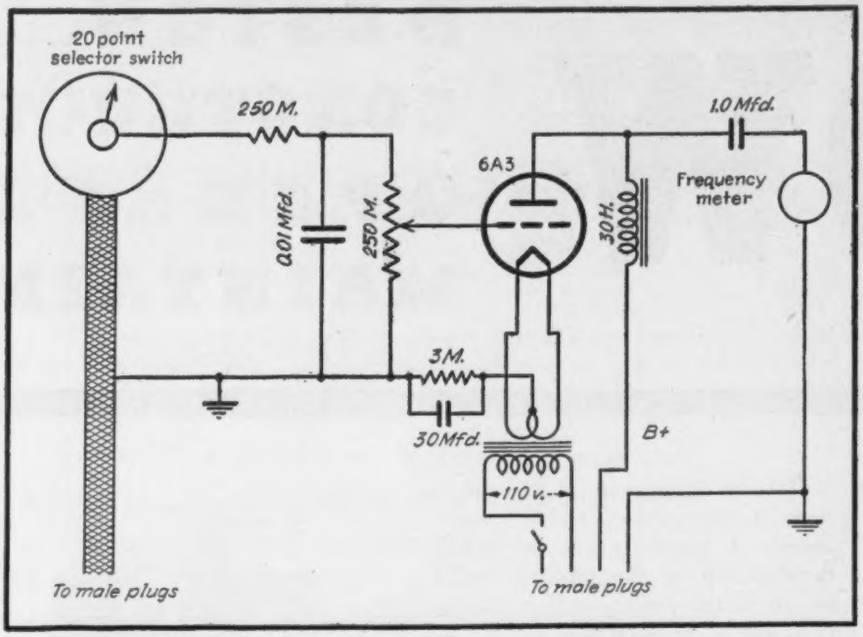
Mica tubes are used for dielectric in the condensers, while plates consist of a brass rod inside the tube and wrapping of copper wire on the outside. A suitable micoid box is filled with Ozite to insure dielectric strength all around. The gas-filled tube is mounted in fuse clips on the outside of the box and suitably protected as



LIGHT in weight, safe, rugged and compact, this condenser-gas-tube-phasing device will stand up to 46 kv. and yet indicate voltages as low as 2.4 kv.


Condenser Detail
10"
4"
Brass rod 5/8"x 4" all corners rounded
5/8"
1 1/2"
100% mica tubing
Wrapped with No. 18 soft drawn copper—4"
Completely fill interior with Ozite A
6"
4"
Solder
Note:-
All stock 3/8" Micoid
Brass screws
54" leather strap—1/8"x 1 1/2"
Supply 2-10' lengths of 15 kv. Neon Tube cable, No.14 G.E. type G.T. or equal
No sharp edges to be left on soldering; sand or file smooth

HIGH-VOLTAGE CONDENSER construction details



SEVERAL FREQUENCIES cabled to test stations are locally amplified by 6A3 tube overbiased to reduce drain from power supply. Common filament transformers used for contiguous stations

shown just above the lettering in the accompanying illustration.

This idea received a special award in the company's 1942 employee suggestion contest.

•

Frequency Channels for Meter Calibration

By **DONALD E. ANDERSEN**
Chief Engineer, J-B-T Instruments, Inc.
New Haven 8, Conn.

Various frequencies generated by individual tuning fork electronic oscillators at a central location and transmitted over cables at low power level to many points provide flexibility for calibration of frequency meters and other tests. An amplifier at each receiving station furnishes power as required and is equipped with a selector switch to enable the operator to choose the frequency desired.

With only one frequency it might have been more convenient to build one high power amplifier with automatic voltage control. However, with the present setup, using 15 different frequency channels, a power amplifier for each one would be impractical. For this reason it was decided to furnish individual amplifiers for each station and these may be used for various purposes, such as calibrating reeds, or checking and standardizing oscillators.

First, any number of operator's positions and laboratory test outlets can be provided and used when desired and additions or changes can be made whenever production dictates. Second, the scheme permits use of a single set of standards which can readily be checked in the laboratory against standard time signals from the Bureau of Standards. This is much to be desired over the practice of using individual standards for each operator. Third, it permits the checking of frequencies other than those of the fundamental standards.

Frequencies of any multiple or submultiple of any tuning fork may be checked and standardized. For example, with the 50-cycle channel, 25, 50, 100, 200 and 400 points on an oscillator may be maintained correct within 0.04 percent, which is the maximum permissible deviation of any fork. This is done by directing light from a Strobotron operating from the oscillator onto a vibrating reed actuated by the tuning fork circuit.

The accompanying diagram shows the amplifier circuit used in the control panels. Since the output of the tuning fork oscillators is 40 volts, it was unnecessary to provide for voltage gain. A 6A3 tube was chosen because of the low impedance of the frequency meter unit used in the output circuit. Since the tube was not required to deliver full power, it was overbiased to cut down drain from the power supply.

•

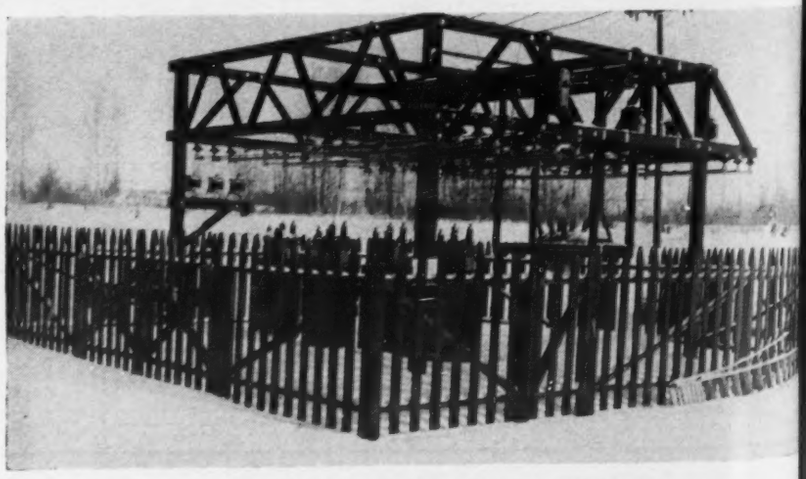
Pine Timbers Used for Co-op. Substation

By **JAMES A. DeWINTER**
J. & G. Daverman Company,
Grand Rapids, Mich.

A substation structure of wood members and using a minimum amount of iron and steel in its construction was built by the Presque Isle County Electric Co-operative Association, Onaway, Mich., to replace an old and weakened steel structure substation.

The wood structure was erected **at the Tower hydro plant** and is used in conjunction with a bank of three 200-kva., 2,300-7,200-volt transformers to connect the plant with the co-operative's rural lines.

Built on a concrete slab, 19x21 ft, the structure consists of creosoted yellow pine timbers bolted together



SUBSTATION STRUCTURE and fence made of creosoted yellow pine

HOW TO MODERNIZE YOUR STREET LIGHTING AT MINIMUM COST

Use a "Master Plan" When Ordering Renewal Parts

Do you find that the older luminaires in your street-lighting system become more difficult and expensive to maintain each year? You can replace them gradually, without wastage, by using the economical plan described in the G-E *Novalux Renewal-parts Catalog.*

By following this master plan, you can order lighting parts, for immediate use or for stock, in such a way that you can gradually retire the older types of luminaires and standardize your equipment with the modern renewals. Standardization reduces the quantity of stock parts needed and greatly simplifies ordering and obtaining them. This plan helps you to make the greatest possible savings in maintenance and in the cost of modernizing your system.

G-E Renewal-parts Service Makes It Easy to Order

You can set up an economical, permanent system for reordering by using the company-personalized Standardization Charts which we will make, on request, to illustrate the particular combinations of parts that you use. Also, G-E Renewal-parts Service includes leaflets that contain detailed data on the most commonly used G-E Novalux parts. Your G-E lighting specialist will be glad to assist you in getting all the benefits of this service.

Catalogs Still Available... Have You Sent for Yours?

This pictorially indexed catalog will identify your parts quickly. It presents the suggested master plan for the control of stock and gives other helpful information. Send for your copy of GEA-4084. *General Electric Company, Schenectady, N. Y.*

Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds

GENERAL ELECTRIC

452-24-3010

LIGHTING IS YOUR BASIC LOAD BUILDER...

AFTER THE WAR, LIGHTING WILL BE YOUR NUMBER ONE MARKET AND — MORE THAN EVER BEFORE — YOUR BASIC LOAD BUILDER

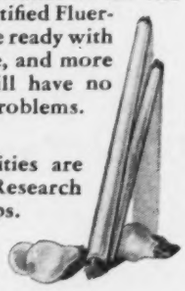
MILLIONS OF EMPTY SOCKETS ARE WAITING TO BE FILLED. Normally in peacetime an average of 10% of the nation's residential sockets are empty. Recent surveys indicate that the figure is now about 17%. That amounts to well over 100,000,000 lamps. And many sockets today are filled with wrong size lamps.

THOUSANDS OF STORES, OFFICES, and other business establishments want G-E fluorescent light just as soon after the war as it can be supplied. So will a lot of factories.

EVEN BETTER FLUORESCENT FIXTURES AFTER THE WAR. The manufacturers of Certified Fluer-O-Lier and RLM fixtures will be ready with lighter, stronger, more durable, and more efficient fixtures. And they will have no difficult post-war conversion problems.

EVEN BETTER G-E LAMPS will be available after priorities are lifted. You and your customers can be sure that G-E Research will continue to improve the quality of G-E Mazda lamps.

In short, everything indicates that lamps and lighting will be your best bet for immediate post-war load building. Why not start planning for it now?



YOU CAN START PLANNING THESE THINGS RIGHT NOW

1 *An immediate post-war empty socket campaign.*

2 *The development of a commercial lighting organization trained to guide the application of fluorescent lighting.*

3 *The development of a home lighting organization especially trained to help home owners get all the benefits from good fluorescent lighting installations.*

4 *A consistent advertising and promotion campaign to support these post-war activities.*

GENERAL ELECTRIC

G-E LAMP PROMOTION IS A BASIC TOOL . . .

Only General Electric offers you all these Helps for Post-War Market Development

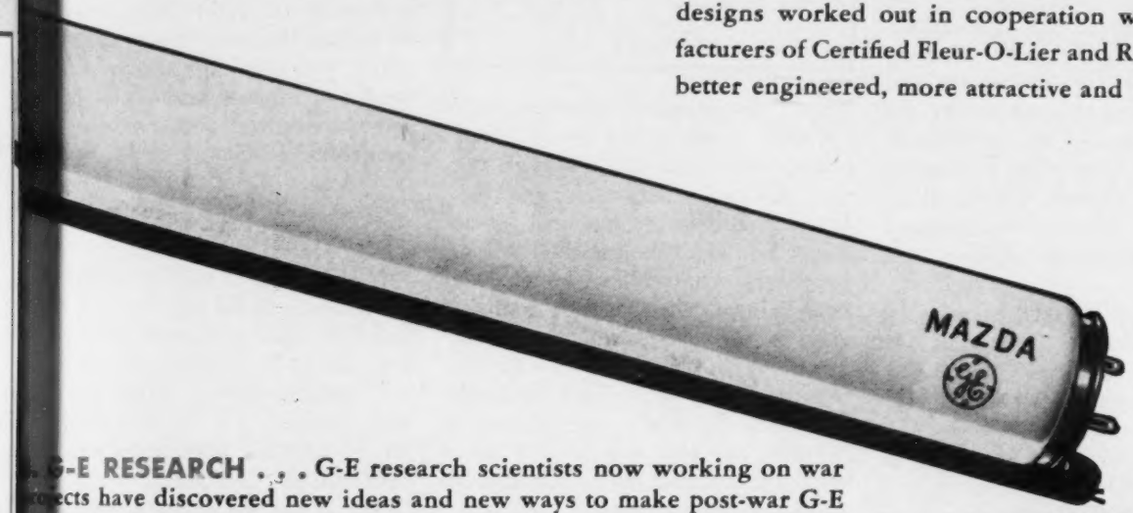
RADIO . . . Broadcast for nearly seven years, "The General Electric All-Girl Orchestra" is the only nation-wide lighting program on the air. *Today* it is telling an audience of 16,000,000 people a month how to get the most out of present lighting equipment and save eyes, too. *Tomorrow* this powerful advertising force will help sell your customers lamps and lighting.

2. COMPLETE LIGHTING PROMOTIONS . . . Those people at Nela Park who developed such successful programs as Bulb Snatching, Light Conditioning and Bomber Builders will produce new promotions—promotions even more successful and helpful.

3. STORE AND WINDOW DISPLAYS . . . Post-war lamp displays for dealer stores and windows will be ready to increase "point-of-sale" appeal . . . displays that will be better designed and more colorful than ever before.

4. MAGAZINE ADVERTISING . . . Today G-E consumer advertising is telling the story of lighting at war and advising consumers how to get the most out of existing lighting. Tomorrow the full force of hundreds of millions of reader messages will be at work to sell *better* lighting.

5. FIXTURES WILL BE READY . . . Many new designs worked out in cooperation with the manufacturers of Certified Fleur-O-Lier and RLM fixtures . . . better engineered, more attractive and more saleable.



6. G-E RESEARCH . . . G-E research scientists now working on war projects have discovered new ideas and new ways to make post-war G-E lamps stay brighter longer . . . lamps that will give your customers better lighting than ever before.

* * *

Hear the General Electric radio programs: "The G-E All-Girl Orchestra," Sunday 3 p.m. EWT, NBC; "The World Today," news every weekday, 6:45 p.m. EWT, CBS

THE BEST INVESTMENT IN THE WORLD IS IN THIS COUNTRY'S FUTURE — BUY WAR BONDS

G-E MAZDA LAMPS

with galvanized bolts and "TECO" ring connectors. While very little bracing is used on the entire structure it is extremely rigid. Largest timbers used were 6x6-in. posts on the corners, the remainder of the members being 3x6-in. and 2x4-in.

Over-all dimensions at the posts are 17¾ x 20 ft. and at the bottom chord of the truss members are 22 x 20 ft. The structure is 14 ft. high over all, with 10-ft. clearance from the ground line to bottom of lower truss members. The corner posts are fastened to the concrete base by means of four 4 x 4 x ¼-in. angles 6 in. long on each post, bolted to the concrete and to the post. The inclosing fence, 30 x 30 ft., is also built of creosoted yellow pine nailed and bolted together. Fence pickets are 6 ft. long.

•

Quick Tests of Repaired Transformers

By S. LEE
Shop Superintendent Westinghouse Manufacturing and Repair Department, Atlanta, Ga.

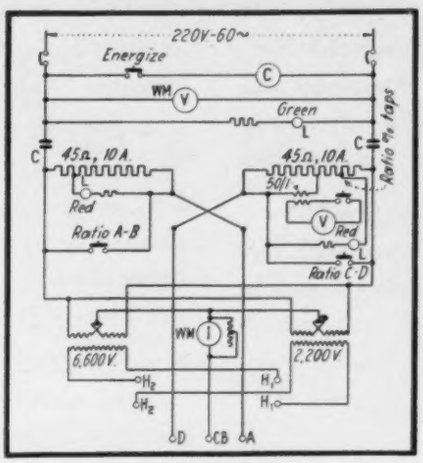
Usual procedure for testing repaired or rewound transformers for ratio is to use two voltmeters and transpose the meters to correct for possible difference in calibration. Due to voltage fluctuations two testers usually make this test. The usual requirement for repaired transformers is that ratio be within one-half of 1 percent.

The transformer test box here described simplifies this test and clearly indicates on a single meter the exact voltage ratio to within one-tenth of 1 percent by touching a button, regardless of fluctuation in line voltage. In addition to indicating ratio it will make the following tests as simply, all of which can be done within a few minutes time:

1. Indicate subtractive or additive polarity.
2. Indicate percentage tap position.
3. Indicate a short circuit within the transformer.
4. Indicate incorrectly connected coils.

Most distribution transformers repaired at a particular location are of the same ratio. The cubicle test box described here is for testing 60-1 and 20-1 ratio transformers, but can be made for any combination. The principle of comparing a standard transformer to a transformer under test is not new, neither is the use of a wattmeter to indicate difference in voltage, but the arrangement described here has been made practical for accurate and rapid testing, and is foolproof. No damage can result from connecting a transformer of improper ratio to the wrong terminals, or connecting a short circuit across the terminals. Safety is provided for by the use of a "hold-in" push button to energize the test circuit only when the tester is facing the cubicle and the transformer under test.

PANEL ARRANGEMENT and connection diagram of ratio and polarity test equipment for repaired transformers



Referring to the drawing, it will be seen that resistors are used to limit the current resulting from connecting a transformer in opposite polarity. This feature is used to light signal lamps, by tapping the resistors at the proper place to light when current flows through the resistors. Red signal lamps indicate incorrect polarity or any incorrect connection which would cause excessive current to flow in the resistors. This feature is also used to indicate percentage tap ratio by tapping one of the resistors at the proper place, to indicate percentage voltage on a suitable voltmeter, calibrated from zero to 20 percent.

A wattmeter having zero center scale and 300-volt potential coil and 5-amp. current coil is used for indicating ratio variation. The voltage across the potential coil is in phase with the voltage of the transformer under test. The current coil is in series with the common low-voltage circuit connecting the transformer under test and the standard transformer. A resistor is shunted across the wattmeter current coil for the purpose of calibrating the wattmeter in terms of percentage off ratio. Any difference in voltage between the transformer under test and the standard transformer will force current through the wattmeter current coil and deflect the wattmeter.

Test Procedure

The procedure for testing a transformer with this unit is to connect the transformer to the test box with H.V. and L.V. leads connected as the tester assumes to be correct, and touching the energize button which operates the contactor (C). If the polarity is wrong or if the low-voltage coils are reversed the red signal lamps will light. If the red lamps do not light the percentage (Ratio, % Taps) button is held in, with the energize button also held in. If the transformer is badly off ratio or connected to a percentage tap the voltmeter can be read. If the voltmeter does not indicate its minimum marking of 2½ per cent off ratio the A-B or C-D button is closed, which short circuits the respective one of the two resistors. Any slight difference in voltage between the standard transformer and transformer under test will result in circulating current through the two low voltage windings and the current coil of the wattmeter, which then will show an indication.

REVERE OPENS LARGEST MAGNESIUM SHEET AND STRIP ROLLING MILL IN THE WORLD AT BALTIMORE

BALTIMORE, October 1st — Revere Copper and Brass Incorporated announces its entrance into magnesium production. It will soon begin operating the largest magnesium sheet and strip rolling mill in the world.

It is indeed significant that Revere—the oldest name in the entire non-ferrous industry—now becomes associated on a large, important scale with the newest metallic material whose almost magical lightness and versatility predestine it to an epoch-making future.

It may be well said that the pioneering spirit of Paul Revere himself still carries on with all its trail-blazing fame.

The Company is planning a limited production for the immediate future, but will increase the quotas until the mill reaches its capacity in January, 1944.

Three Important Alloys Offered

Revere will make three most commonly-used sheet magnesium alloys.

Revere Magnesium "M" will be a magnesium-manganese alloy, possessing moderate strength with good forming characteristics.

Revere Magnesium "J-1" will also be offered. This is the highest strength sheet on the market, used principally by the airplane industry. This is a magnesium-aluminum-zinc alloy.

In addition, *Revere Magnesium "FS-1"*, a magnesium-aluminum-zinc alloy will be produced. This alloy will possess higher physical characteristics than "M", but lower than "J-1" and, combining with these improved strengths, it will also possess a good forming quality.

a large producer of magnesium sheet d strip, and in view of the expanding efulness and applicability of this wonrously light metal, Revere will now be ble to serve American industry in many elds, from aviation to railroads.

Some typical uses in addition to transortation: various small mechanical arts; reciprocating elements in textile achinery; works of calculating maines; housing for portable machinery; pewriter frameworks—the possibilities e almost endless it would seem. As delopments ensue, Revere will be ready supply requirements and offer appropriate technical advice.

The new Research and Development epartment of the Magnesium-Aluminum ivision at Baltimore will be of material d in working with Revere customers in e solution of any of their particular anufacturing problems.

Manufacturers who would know more the possible adaptability of the various evere magnesium alloys to their needs, e invited to write us, *without obligaon.* Address all inquiries to:

evere Copper and Brass Incorporated, agnesium-Aluminum Division, O. Box 2075, 1301 Wicomico Street, altimore 3, Maryland.

REVERE

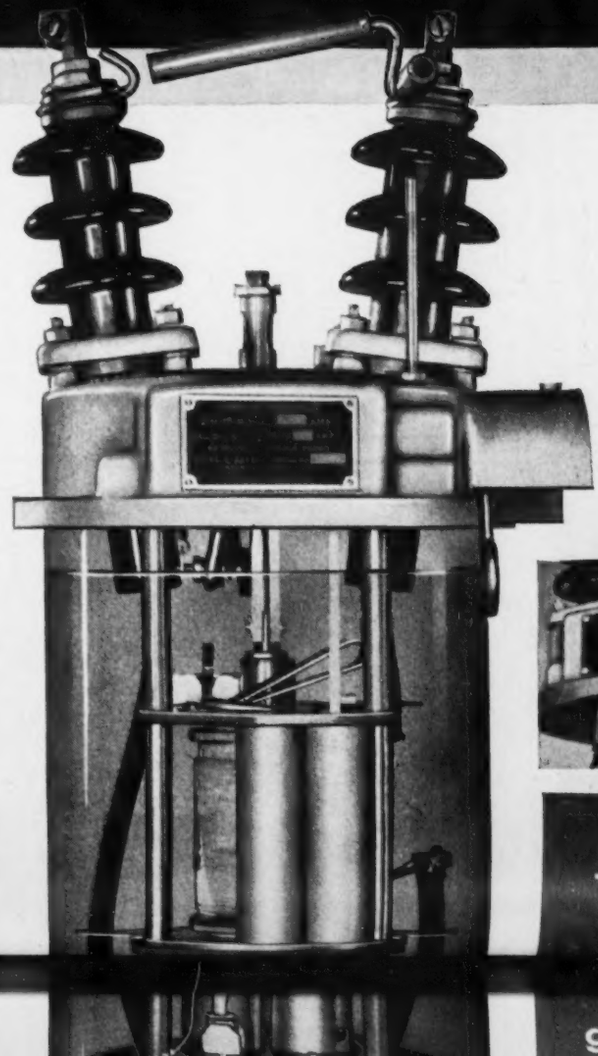
COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

Executive Offices: 230 Park Ave., New York 17, N. Y.

UY TODAY MORE WAR ONDS AND PAVE THE WAY TO VICTORY

Only the KYLE CIRCUIT BREAKER
has all these safety features

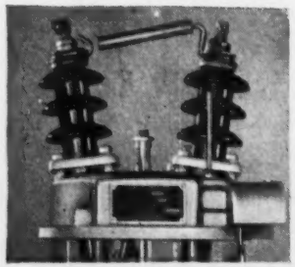


Once the breaker is open there is not a chance of it closing until it is physically closed by the operator. The Kyle Oil Circuit Breaker can never fall closed under any conditions of bumping or vibrating. It does not rely on any latch or catch to hold it open.

The two line terminals above the breaker are the only exposed live surfaces.

THE HEAD IS DEAD
THE OPERATING HANDLE IS DEAD
THE TANK IS DEAD

The terminals are the only exposed live parts of the Kyle Circuit Breaker. These are located at the top to prevent the hazard of accidental contact when inspecting or working near the breaker.



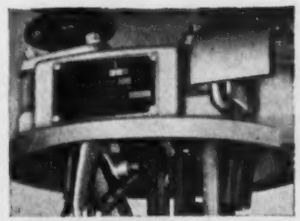
★

Normally open position of the breaker after locking out insures that any mechanical failure of the closing mechanism will leave the breaker locked out and harmless to life and property.

Both terminals at the top, allows pole mounting with perfect safety

Breaker normally

terminal



Trip-free handle

grounded

The entire top, consisting of the operating handle and cover, is dead. The handle used for operating the breaker is exclusively Kyle design and is not directly connected to the operating mechanism of the breaker. It is impossible for a blow from the mechanism to be imparted to the operator.

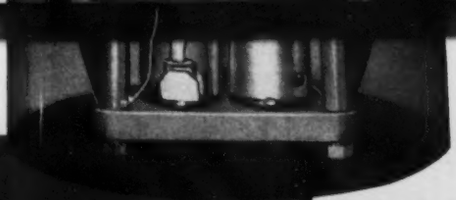
★

The operating mechanism is trip-free of the handle and, therefore, operation by means of the handle is safe. Although the breaker mechanism operates three times before locking out, the handle only moves on the lockout. The handle

for grounding it. Its metal construction affords rapid dissipation of interior heat.

both terminals at the top, allows pole mounting with perfect safety

terminal



grounded

tion affords rapid dissipation of interior heat.

Plunger is Hydraulically cushioned

urges cause no mechanon the breaker. These controlled by external plunger will not tele-atter—its action is dend positive.

Large size coil wire reduces heating

heating to a minimum, the coil in the Kyle arge. This also reduces p through the breaker. es heat hazard which used by high resistance verload.

Burning up due to temporary overloads is prevented by use of a thermo-tripping device. This operates only when the inside breaker temperature reaches approximately 200° F.

Thermo-Trip prevents overheating

Kyle design provides special arcing contacts and does not arc from current carrying contacts. This prevents burning of the current carrying contacts. Heating is eliminated by the use of wiping pressure contacts. The load is always carried on clean contacts.

Arcing contacts prevent burning

Safely hung on a pole

The Kyle Breaker can be safely hung on a pole. Its construction, with live terminals at the top, assures that a lineman cannot be injured by climbing against the tank which is always "dead"

All parts sealed from weather

All parts of the Kyle Circuit Breaker are completely sealed from exposure to the elements. The cover is easily removed and the entire unit may be quickly removed for inspection or repairs.

In addition to protecting the lineman the Circuit Breaker protects itself and thereby protects your lines and service

KYLE CORPORATION

SOUTH MILWAUKEE, WISCONSIN

Kyle Oil Circuit Breakers Are Sold Only Through the Following Offices of the LINE MATERIAL COMPANY, MILWAUKEE, WISCONSIN

Albany 7, N. Y. • Amarillo, Tex. • Atlanta 3, Ga. • South Boston 27, Mass. • Charlotte 2, N. C. • Chicago 4, Ill. • Cincinnati 2, O. • Cleveland 14, O. • Dallas 2, Tex. • Denver 2, Col. • Des Moines, Ia. • Detroit 2, Mich. • Indianapolis 4, Ind. • Kansas City 6, Mo. • Los Angeles 54, Calif. • Memphis, Tenn. • Milwaukee, Wis. • Minneapolis, Minn. • New Orleans, La. • New York 6, N. Y. • Philadelphia 2, Pa. • Pittsburgh, Pa. • Portland 9, Ore. • Richmond 2, Va. • St. Louis 2, Mo. • San Francisco, Calif. • Seattle 1, Wash. • Tampa 2, Fla. • Toronto 13, Canada • Tulsa 3, Okla. • Washington 5, D. C.

HOW TO MAINTAIN ELECTRONIC CONTROL

By W. D. COCKRELL, Industrial Engineering Division, General Electric Company, Schenectady, N. Y.

Trouble	Cause	Remedy
Loose connection, or leads breaking.	Excessive vibration.	Install extra-flexible connections.
Reduced tube life, or tube failure.	Vibration or mechanical abuse.	Shock-mount the control panel and use extra-flexible leads. Prevent objects from striking tube holders and sockets. Elements may be jarred out of position or the weld on leads may be broken.
WARNING: Tube filament or heater circuit may be at high voltage above ground. Use extreme care in making measurements and adjustments.	Natural deterioration. Usually failure is due to gradual loss of electron emission as the active cathode material is used up or flakes off.	Be sure deterioration is at a rate consistent with expected life for each type of tube in its particular service. If the tube life seems too short, see following recommendations.
	Incorrect voltage on filament or heater.	Check voltage at tube terminals frequently to determine nature of error. Do this with tube in socket both with and without anode load connected.
	If voltage is: Fluctuating (more than plus or minus 5 percent from rating)	Install voltage regulating transformer.
	Consistently high or consistently low	Adjust taps (if any) on transformer, or install new heater transformer, or install auto or booster transformer to correct voltage.
	Erratic-- on and off.	Check wiring from heater supply to tube sockets for loose connection or break.
	Ambient temperature too low or too high.	Provide extra heat or forced air cooling to hold temperature within limits specified in tube instructions. Ambient temperature should be measured at the tube. Consult tube instruction sheet before applying cooling means.
	Excessive loading. Operators may have increased anode voltage, replaced coils, or made other changes to obtain greater output.	Tube should not be operated at outputs greater than those for which it has been designed.
	Too frequent operation.	When equipment is used intermittently, tube life may be increased by leaving cathodes heated during unloaded periods. This prevents strains caused by too frequent heating and cooling.
Mercury-vapor tubes don't "fire".	Ambient temperature too low.	Measure air temperature next to tube; provide heat to bring temperature up to value specified in tube instructions. Manually or thermostatically controlled strip heaters are recommended.
Arc-backs after tubes have warmed up.	Ambient temperature too high.	Provide forced-air cooling according to instruction sheet on tubes. (Mercury-vapor tubes are rated on the basis of "condensed mercury temperature.")
Arc-backs when tube is first placed in service.	Mercury vapor splashed on elements during shipment or handling of tube. Tube not kept in upright position.	Heat the tube cathode to distill this mercury before anode power is applied. Make sure cathode is heated for the length of time stipulated in instructions furnished with tube.
Failure of tubes to operate when starting equipment.	Interlocks or protective control devices not operating properly.	Check contacts to see that they close and that they are clean.
	Cathode protective timer has not completed its timing cycle.	Wait until timing cycle is completed before attempting to operate equipment.
	No voltage at control panel terminals.	Check external connections to be sure they are correct. Check fuses. Check panel connections to be sure they are right.
	Incorrect power.	Check the terminal voltage to make sure it corresponds with nameplate rating.
	Missing connection.	Recheck the circuit with wiring diagram.
	Tubes will not heat up.	Check with wiring diagram to make sure tubes are in the right places. The thyratron tube will be warm when cathode is heated. Do not touch metal power tubes while power is on the panel.
	Tubes may have been damaged internally through shipment.	Replace tube.
Overheated transformer or reactor.	Overload.	Check cause of overload and remove.
	Defective unit.	Warning is usually given by the odor of excessive heating, melting of the sealing compound, smoking or charring of the insulating paper. Replace transformer.

Trouble-shooting chart for all types of electronic control. (A similar chart for photoelectric control will be published in a subsequent issue)

Engineered specifically for modern full float service!

PHILCO FLOTÉ BATTERY

Philco Floté is the only battery design engineered specifically for the exacting requirements of modern full float charging! The Philco Floté grid of special metal not only retards peroxidation by exposing a minimum of grid metal on the plate surface, but it also provides superior conductivity and exceptional strength. This special metal and design reduces the amount of current necessary to maintain the charge *by as much as 40%.* Specify Philco Floté Storage Batteries for the most advanced engineering and rugged, dependable construction.

SPRAY-PROOF CONDENSING AMBER VENT. NO DAMAGE TO AR-BY EQUIPMENT

CURATE BUILT-IN DICATORS SHOW TE OF CHARGE AT A GLANCE

PHILCO FLOTE OSITIVE PLATES, HARD RUBBER RETAINERS D DOUGLAS FIR SEPARATORS

CIAL NEGATIVE PLATE OXIDE OR MAXIMUM TTERY CAPACITY

P ACID CHAMBER BENEATH TTERY ELEMENT

BOLTED POSITIVE AND NEGATIVE POSTS

TIGHT WEDGE ASSEMBLY TAPERED CORNER AND SIDE LOCKS

SEMI-SOLID OUTSIDE NEGATIVE PLATE

LATERAL ELEMENT SUPPORTS. NO STRAIN ON ELEMENT

STEEL GLASS JAR, CAST AND ANNEALED, HALF-INCH THICK

For Control and Stand-by service, Philco Floté Batteries in Steel Glass jars are available in cell capacities from 10 A.H. to 1056 A.H. In Philco Vitrabloc jars, capacities range from 240 A.H. to 1680 A.H. Write for the Philco Control and Auxiliary Power Battery catalog.

PHILCO CORPORATION, STORAGE BATTERY DIVISION, TRENTON 7 NEW JERSEY

SPECIFY PHILCO FLOTÉ BATTERIES

CYCLOGRAPH used to check case hardening depth of roller bearings. The bearing in the coil fixture (box) constitutes the core of the coil and produces in a tuned current power losses which are measurable and used to give indications on a cathode-ray tube screen

Cyclograph Tests, Sorts Metallurgically

An electronic instrument known as the "cyclograph" has been designed to perform both quantitative and qualitative metallurgical tests on both ferrous and non-ferrous metals, without the necessity of damaging the samples. It is adapted to facilitate the checking, evaluating and automatic sorting of the materials according to their metallurgical properties. Some of these properties which have been investigated successfully include measurement of case depth, plating thickness, carbon content, brittleness and variations in heat treatment. Such measurements require that all properties except the one under observation remain reasonably constant from sample to sample.

The instrument, manufactured by the Allen B. DuMont Laboratories, Inc., Passaic, N. J., can be used also as a metal locator to detect the presence of any metal in non-magnetic material, with a sensitivity depending upon the mass of the particles to be detected.

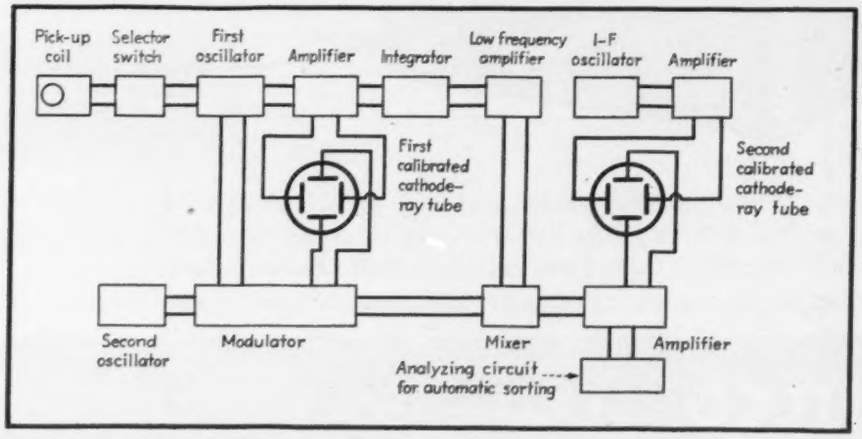
Designed around two 5-in. diameter cathode-ray tube indicators, the cyclograph utilizes the principle that the metallurgical properties noted above cause variations in the core loss of a tuned pickup coil which surrounds the piece under test. These variations affect the shape of an easily visible pattern or "cyclogram" displayed on the indicator screen.

The instrument is connected to a 115-volt, 60-cycle, single-phase power source and consumes approximately 250 watts. By electronic tubes and accessories commercial-frequency current is converted to test currents of 1,000 to 500,000 cycles. Two dials on the panel are provided for positioning and size of image on the screen. The schematic diagram shows the interconnected devices in the cyclograph.

Two or three frequencies are used, depending on the job to be done. For each specific material the frequencies are selected at the instrument manufacturer's plant or by a technician sent to the job, and the final frequency settings are under a locked cover on the panel front, between the indicator screens as shown in the illustration.

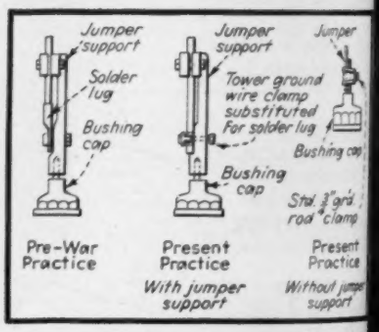
Core losses are a function of the frequency of the oscillations which are being used. Ordinarily the lower frequency is used to measure the hysteresis loss and the higher frequency for skin or surface layer loss, such as when a piece is case hardened.

In the evaluation of physical properties, such as toughness of shot, two standardizing readings at proper frequencies establish that the shot is of the expected analysis and that heat treatment has not been erratic. A third frequency is used to determine the toughness or brittleness of the particular shot. These measurements can be done simultaneously or one after the other.



BLOCK DIAGRAM of cyclograph

Solder-Saving Practice



Accompanying sketches illustrate one of the minor changes in practice adopted by Kansas Gas & Electric Company as a wartime conservation measure. Solder lugs formerly used in making connections to transformer jumper supports have been superseded by tower ground wire clamps installed as shown. A number of ground wire clamps were available in stock, but the solder lugs—as well as solder—are a scarce item.

Why Is an RCA Electron Tube Like Sherlock Holmes?

THINGS that were beyond the ken of ordinary mortals were "elementary" to the man in the fore-and-aft cap.

And why was this?

Simply because Holmes could analyze more deeply, see more thoroughly into the core of things, be more observant of little things than anyone else.

A modern Sherlock Holmes is the RCA Electron Tube employed in an electronic device to check tungsten wire leads for radio tubes.

With this difference: Sherlock master-minded *after* the crime. The electron tube in this device is the magic brain that detects microscopic flaws in wire leads *before* they can cause harm!

For with the aid of this device, powered with an RCA electron tube, a tiny flaw in a wire can be discovered instantly—and the faulty wire rejected before it finds its way into a completed tube assembly resulting in a leaky tube.

This is electronics in action *now*—at RCA.

Although your problem may be the detection of flaws in material other than wire, this basic principle of detection may offer very real possibilities. There are few problems of this or associated types that the electron tube cannot solve to advantage. If your production warrants a priority, your engineers may be able to build such a device around an RCA Electron Tube. The know-how exists at RCA—*for the magic brain of all electronic equipment is a tube, and RCA is the fountain-head of modern tube development.*

May we send you the illustrated booklet "Electrons in Action at RCA"? Write Room **452**, Tube & Equipment Dept., *RCA Victor Division*, RADIO CORPORATION OF AMERICA, *Camden, New Jersey.*

TUNE IN "WHAT'S NEW?" *RCA's great new show, Saturday nights, 7 to 8, Eastern War Time, Blue Network.*

To detect flaws in wire leads for RCA tubes, wires are tested by placing them in the magnetic circuit of one of two radio-frequency electronic oscillators. These oscillators are coupled to produce a beat frequency which is dependent on the relative frequencies of the two oscillators. Since a faulty and a perfect wire produce different beat frequencies, as shown by an output meter, an observer watching the meter can instantly detect and reject the faulty piece.

RCA ELECTRON TUBES

HOW TO REMEMBER THE WIRE TABLE

By JOHN L. SKEEHAN, Baden, Pa.

For No. 10 AWG wire, standard annealed copper at 20 deg. C. (60 deg. F.) approximate data can be remembered by the following rule*:

(1) Diameter = 0.10 in. (more accurately 0.1019)

(2) Area = 10,000 cir.mil (more accurately 10,380)

(3) Resistance = 1 ohm per 1,000 ft. (more accurately 1.018)

(4) Weight = 31.43 lb. per 1,000 ft. (approximately π lb. per 100 ft.).

On the basis of the foregoing data for No. 10 wire it is possible by means of an ordinary slide rule, with one setting, to determine within about 2 percent the characteristics of any wire from No. 40 to No. 4/0.

Turn the slide of the rule over to bring into view the logarithmic scale. On most slide rules the log scale reads from 0 at the left-hand end. For our purpose see that the 10 on the log scale is at the left hand, inverting the slide if necessary. The figures will be inverted, but readable.

From the wire table:

No. 10 wire has approximately 10,000 cir.mil area (1.022 cir.mil). (Wires between No. 10 and No. 1/0 range from 10,000 to 100,000 cir.mil).

No. 20 wire has approximately 1,000 cir.mil area (1,022 cir.mil.) (Wires between No. 20 and No. 10 range from 1,000 to 10,000 cir.mil).

No. 30 wire has approximately 100 cir.mil area (100.5 cir.mil). (Wires between No. 30 and No. 20 range from 100 to 1,000 cir.mil.)

No. 40 wire has approximately 10 cir.mil area (9.888 cir.mil). (Wires between No. 40 and No. 30 range from 10 to 100 cir.mil.)

With the 10 on the log scale set at 104 (the significant figure nearest 10,380), on the lower *D* scale, check the readings on the *D* scale under 9-8-7, etc., of the log scale with your wire table. You will find that the significant figures of the readings on the *D* scale compare very closely with the circular mil table for 9-8-7, etc., wire.

Under 6 on the log scale read 261 on the *D* scale.

Keeping in mind the size range between the various 10 groups of gauges, we know that:

No. 6 wire is larger than No. 10. Therefore, No. 6 wire, by the slide rule reading, has 26,100 cir.mil (actually 26,250).

No. 16 wire is smaller than No. 10 and will fall in the range between 1,000 and 10,000 cir.mil.

The reading 261 gives No. 16 wire 2,610 cir.mil (actually 2,583).

Section of Slide Rule	L.-H. End	Center	R.-H. End
Marks on A scale	1	1	1
Values of A scale readings as squares of corresponding figures on *D* scale	0.0001 0.01 1. 100. 10,000. (26,100)	0.001 0.1 10. 1,000. (2,610) 100,000.	0. 1. 100. 10,000. 1,000,000.

EXAMPLES

1. To find the diameter of a wire of a given circular mil:

The *A* scale of the slide rule is divided into two sections. In using the slide rule for square root calculations be careful to use the proper section of the *A* scale.

Reading on the *A* scale in proper relation to *D* scale are shown in the accompanying table.

2. To find the diameter of No. 6 wire:

The significant figure 26,100 falls in the left-hand section of *A* scale.

Set the runner on 261 in the left-hand section of the *A* scale and read 162 on the *D* scale.

No. 6 wire is in the group of ten larger than No. 10, which is about 100 mils diameter; therefore, No. 6 is 162 mils or 0.162 in. diameter, which agrees exactly with the wire table.

3. To find the diameter of No. 16 wire:

The significant figure 2,610 falls in the right-hand section of *A* scale.

Set the runner on 261 in the right-hand section of the *A* scale and read 512 on the *D* scale.

No. 16 wire is in the group of ten smaller than No. 10, which, as before noted, is about 100 mils diameter; therefore, No. 16 is 51.2 mils or 0.0512 in. diameter, which closely agrees with the table valuation of 50.8 mils.

Knowing the circular mil value of any wire, we may, by comparison with the properties of No. 10 wire, determine the resistance and weight for a given length.

* Standard Handbook for Electrical Engineers, 7th Edition, page 280.

WOLFE & MANN at WRIGHT FIELD

BELOW is one of the high-tension, automatic-power transfer cubicles designed and manufactured by Wolfe and Mann of Baltimore for the Air Corps at Wright Field. The Wolfe and Mann Organization is staffed and equipped to give every contract personal attention and expert engineering skill. Ask the folks at Wright Field what they think of the performance and dependability of Wolfe and Mann electrical equipment. Write us about your requirements.

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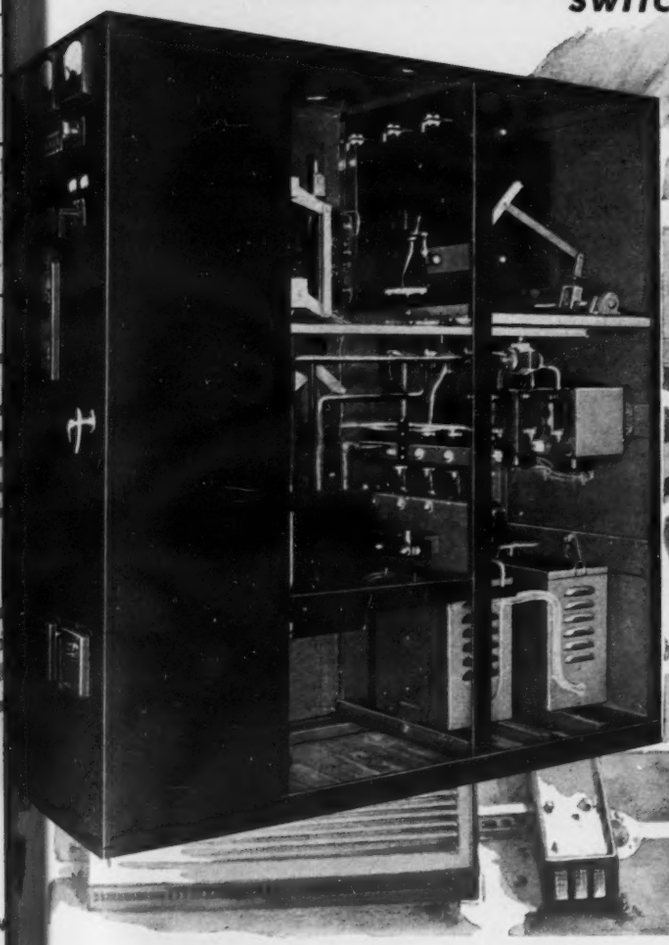
SWITCHGEAR ★ SWITCHBOARDS ★ PANELS

28TH AND SISSON STREETS
BALTIMORE, MARYLAND



These Projects
ARE OUR REFERENCE

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NAVY HIGH POWER RADIO STATION, ANNAPOLIS, MD.
UNIVERSITY OF VIRGINIA
WEST VIRGINIA PULP AND PAPER COMPANY

U. S. GOVERNMENT:
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CURE FOR

electrical absenteeism..

TRUMBULL INDUSTRIAL MULTI-BREAKER

FOR LIGHT and POWER SERVICE

1. *Protect* vital production equipment and services automatically and positively with simple, low-cost circuit-breaker units that are compact, completely enclosed, non-tamperable and require little or no maintenance.

2. *Prevent* unnecessary production delays due to too-rapid "blowing" of protective devices. Trumbull Industrial Multi-Breakers have accurately calibrated and sealed thermal trips that provide a safe time delay to take care of small overloads. In addition they have a positive instantaneous magnetic trip as sure protection against short circuit or high overload.

3. *Restore* service immediately after the cause of trouble has been removed by a simple twist of the operating handle. Nothing to replace or renew. Tripping is clearly indicated by a target in the front cover.

TRUMBULL

INDUSTRIAL MULTI-BREAKERS

SAVE TIME...
CUT "OUTAGES"...
GO "MULTI-BREAKER"!

Available in two sizes for 230 AC only. 2 and 3 pole.

Type M-1, 50 amp. frame s rated 15 to 50 amps.

Type M-2, 100 amp. frame s rated 50 to 100 amps.

Quick-Make and Quick-Br Trip Free Operation. Current terrupting capacity 5000 am R.M.S. at 230 V. AC.

Boxes are equipped with exte front operated handle, self-i cating, which can be locked "on" or "off" position. Furnis for surface mounting only.

Finish: Baked machine gray ena

Trumbullaid Circular 333 sent on request.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY . PLAINVILLE, CONN. . A GENERAL ELECTRIC ORGANIZAT

OTHER FACTORIES AT NORWOOD (CINN.) O. — SEATTLE — SAN FRANCISCO — LOS ANGELES

...With Heat Exchangers, ...ank Capacity 170%

By C. H. McALLISTER
Chief Engineer
...de Water Power Company, Wilmington, N. C.

An installation of three heat ex...angers on a 5,000-kva. transformer ...nk has provided an increase in ...ansformer capacity to 8,500 kva. to ...commodate war loads and has done ... by using a minimum amount of ...rategic metals.

During the summer of 1942 in...eased power requirements to serve ...owing national defense loads in ...stern North Carolina made it neces...ry for Tide Water Power Company ... purchase and install transformer ...oling equipment on a 5,000-kva. ...nk.

First, Fans

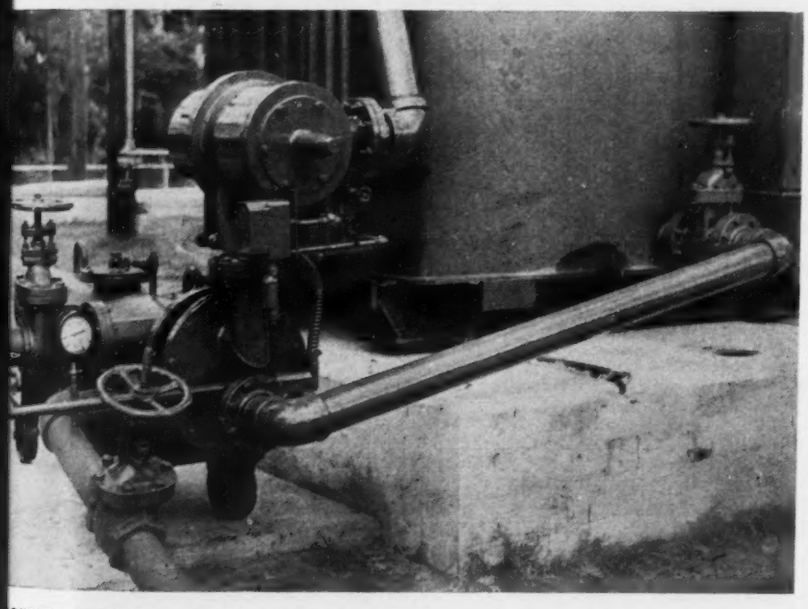
Fans were installed first, to move ...pproximately 24,000 cu.ft. of air per ...inute, and this permitted a 30 per...nt increase in the rating with a ...mperature rise of 55 deg. Later ...me concern was expressed over hot ...ot temperatures resulting from ...rther increases in load at high am...ent levels.

In October of the same year the ad...tion of water-to-oil heat exchang...s was considered and Westinghouse ...gineers were consulted. It was de...rmined that heat exchangers could ... applied to each of the three 1,667-...a. units, permitting a new rating of ...830 kva. per unit, with a copper temperature of 90 deg. C. hot spot and water at 25 deg. C.

Transformer voltage rating is 105,-000 to 34,500, and since the units did not have removable type radiators, it was necessary to replace one of the top manhole covers with a new plate. Through the center of this plate a 4-in. pipe nipple extends down below oil level for the suction line. This nipple is connected to the oil inlet of each heat exchanger which is mounted just above ground level. The oil outlet of the heat exchanger is connected to the main lower 4-in. drain valve—reducing all ells in the piping possible.

The oil pump and three-phase, 220-volt motor were built into the oil inlet section of the heat exchanger. An ammeter provides an indication of actual operating conditions at all times. A 200-ft. well supplies water to each heat exchanger. All three exchangers combined use approximately 150 g.p.m.; 10 hp. is required to drive the pumps. Valves control the flow of water to each exchanger, allowing about 5 lb. pressure drop.

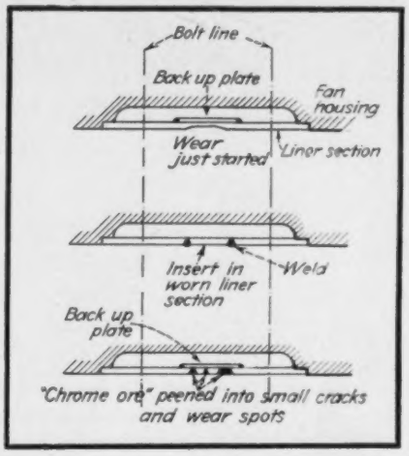
So far overloads on the bank have not reached the maximums for which it was designed. However, tests made at high ambient temperatures verify the full load design capacity. This heat exchanger installation has, in addition to increasing transformer capacity, saved many tons of iron and copper which would otherwise have been necessary for new transformers.



...OSE-UP VIEW of heat exchanger and pump

Gets Extra Life From Exhauster Linings

With the possible exception of the blades there is no part of a pulverized fuel exhauster fan that wears away much faster under the abrasive action of the coal than the mild steel liners. Wear in any liner section is troublesome, but in the top liner sections it is particularly serious because of the danger of pieces of metal dropping into the rotor and wrecking the fan.



THREE WAYS of rejuvenating exhauster fan linings where wear has started

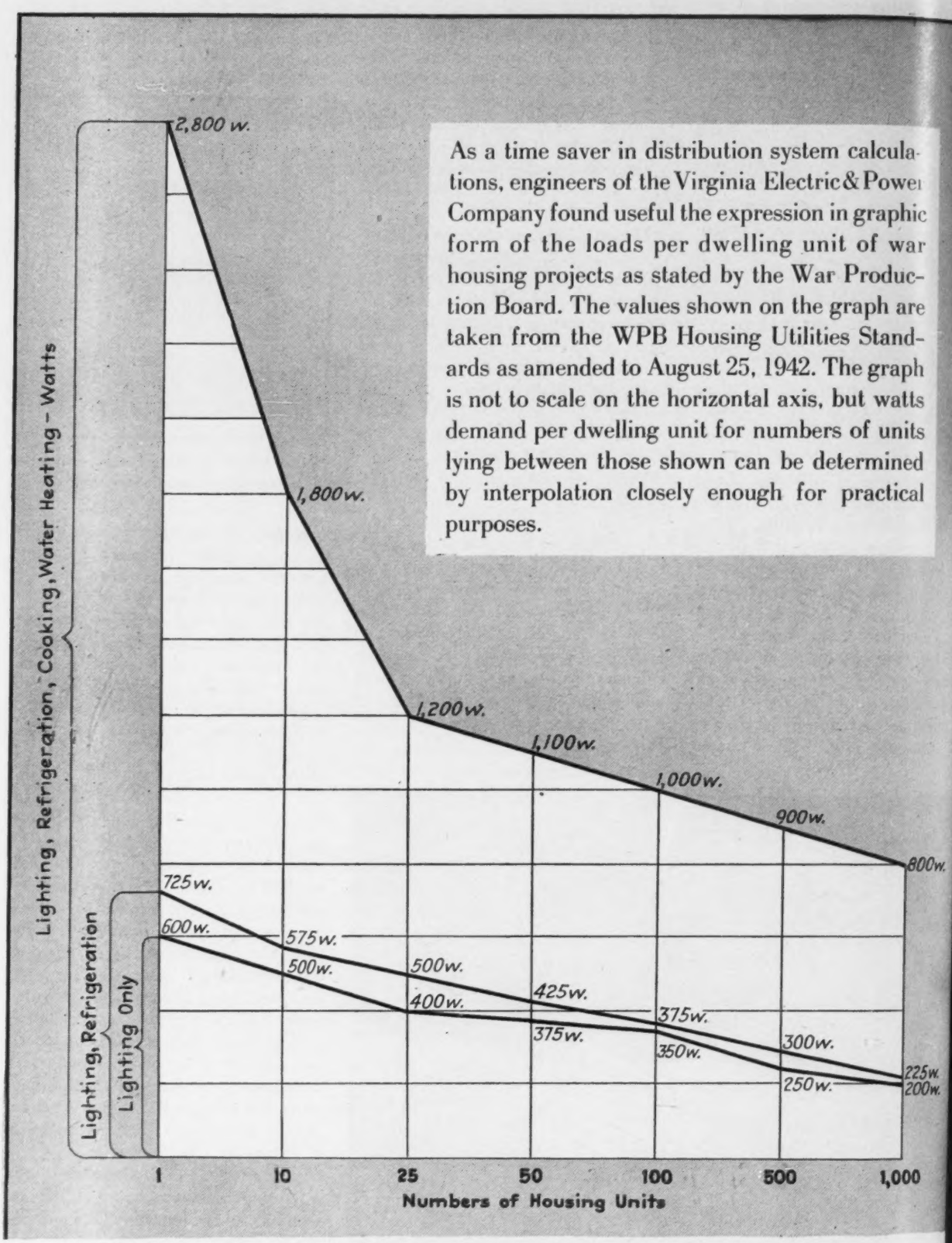
Several methods of giving extra life to liners that have started to wear have been used successfully by the Louisville Gas & Electric Company. Accompanying sketches illustrate some of the methods used.

Where liners have not yet worn through, mild steel plates can be welded to the back of the liner as reinforcing. When the liner has worn through in spots the thin metal may be mortised out and an "inlay" or "insert" of steel plate cut to fit and welded in place. In still other instances where small holes or cracks are just appearing an effective repair has been made by welding a light "back-up" plate to the liner and pounding "Chrome-Ore" into the hole. This is a proprietary material similar to that used to protect headers and tubes in some types of waterwall furnaces. It is tough, malleable and quite wear-resistant. It can also be used to patch cracks between sections of exhauster fan linings.

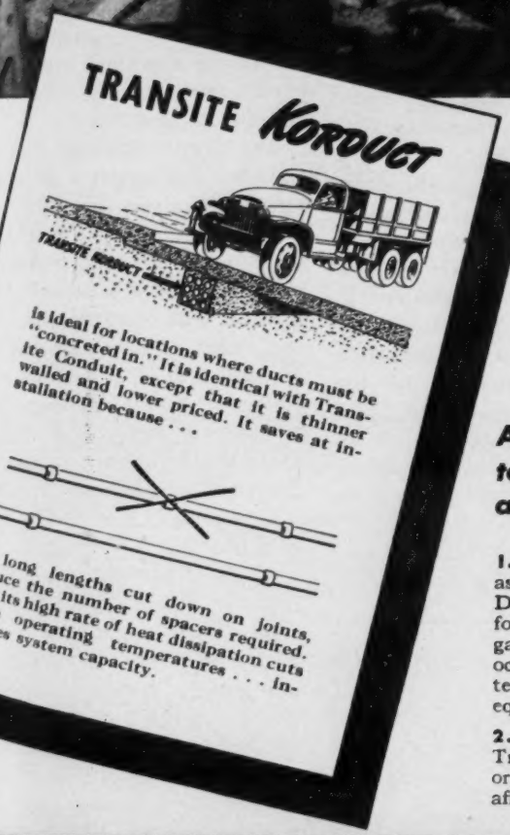
Repaired in any one of these ways a few more thousand hours of life can be added to the fan liners at a considerable saving in cost and at present critical material.

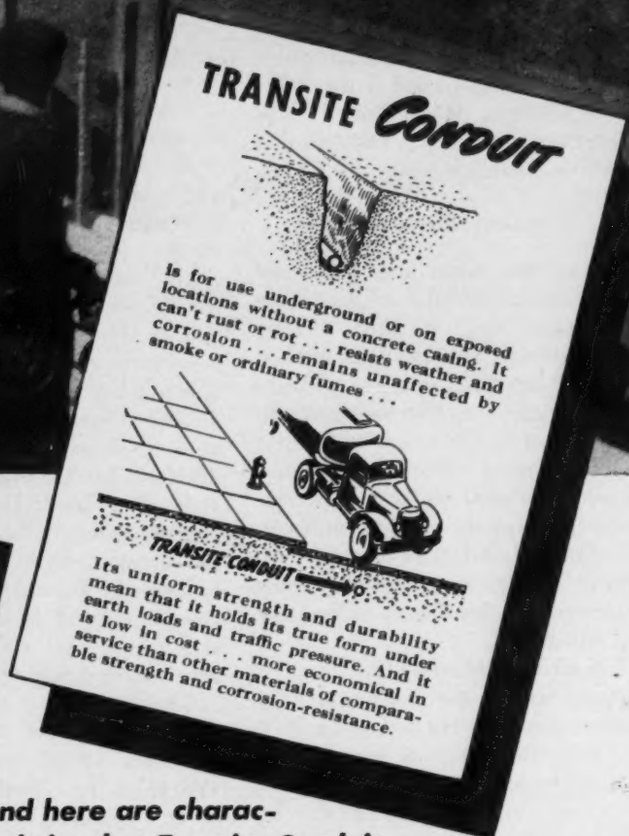
HOW TO ESTIMATE LOADS FOR HOUSING PROJECTS

As a time saver in distribution system calculations, engineers of the Virginia Electric & Power Company found useful the expression in graphic form of the loads per dwelling unit of war housing projects as stated by the War Production Board. The values shown on the graph are taken from the WPB Housing Utilities Standards as amended to August 25, 1942. The graph is not to scale on the horizontal axis, but watts demand per dwelling unit for numbers of units lying between those shown can be determined by interpolation closely enough for practical purposes.



WHAT'S THE DIFFERENCE BETWEEN TRANSITE *CONDUIT* and TRANSITE *KORDUCT*?


TRANSITE KORDUCT
is ideal for locations where ducts must be "concreted in." It is identical with Transite Conduit, except that it is thinner walled and lower priced. It saves at installation because . . .
its long lengths cut down on joints, reduce the number of spacers required. And its high rate of heat dissipation cuts cable operating temperatures . . . increases system capacity.


TRANSITE CONDUIT
is for use underground or on exposed locations without a concrete casing. It can't rust or rot . . . resists weather and corrosion . . . remains unaffected by smoke or ordinary fumes . . .
TRANSITE CONDUIT
Its uniform strength and durability mean that it holds its true form under earth loads and traffic pressure. And it is low in cost . . . more economical in service than other materials of comparable strength and corrosion-resistance.

And here are characteristics that Transite Conduit and Transite Korduct have in common . . .

1. Incombustible . . . Made of asbestos and cement, Transite Ducts won't contribute to the formation of dangerous smoke, gases or fumes. When burnouts occur, they give maximum protection to adjacent cables and equipment.

2. Immune to Electrolysis . . . Transite Ducts are entirely inorganic, non-metallic, cannot be affected by electrolysis.

3. Smooth bore . . . Cable pulls and replacements are easier . . . damage to sheathings is minimized.

4. Easily installed . . . Their combination of light weight, long lengths and quickly assembled couplings speeds up work.

For details and specifications, write for Data Book DS-410. Address Johns-Manville, 22 East 40th Street, New York 16, N. Y.

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How to Close, Trip Circuit Breakers

9. Battery and Capacitor Tripping*

By G. J. EASLEY
Switchgear Engineer, Westinghouse Electric & Manufacturing Company, East Pitsburgh, Pa.

A source of tripping energy must be independent of the main circuit controlled by the circuit breaker. For example, a breaker controlling an a.c. circuit cannot use the a.c. supply directly for automatic shunt tripping, since a fault near the breaker may reduce the voltage below the minimum tripping voltage. However, the main a.c. supply can be used if the light-trip attachment is combined with some of the methods described in this and subsequent articles in this series.

Battery Tripping

One of the oldest and still most widely used methods of tripping uses a shunt-trip coil operated directly from a storage battery. This method should be applied wherever possible since it is the simplest and most dependable; it is also more flexible for various relaying schemes and usually allows more accurate relaying, especially for tripping on low fault currents. In addition, it is especially desirable for high-speed tripping, since it does not require the use of the light-trip attachment.

Circuit breaker standards for shunt tripping specify that satisfactory operation must be obtained using 56 to 112 percent of normal control voltage. If the same source is used both for closing and tripping, the breaker will be able to trip at lower voltages than it will close at, since the minimum closing voltage is 72 percent of normal. Of course, it is more important that the breaker be able to trip than be able to close.

Capacitor Tripping

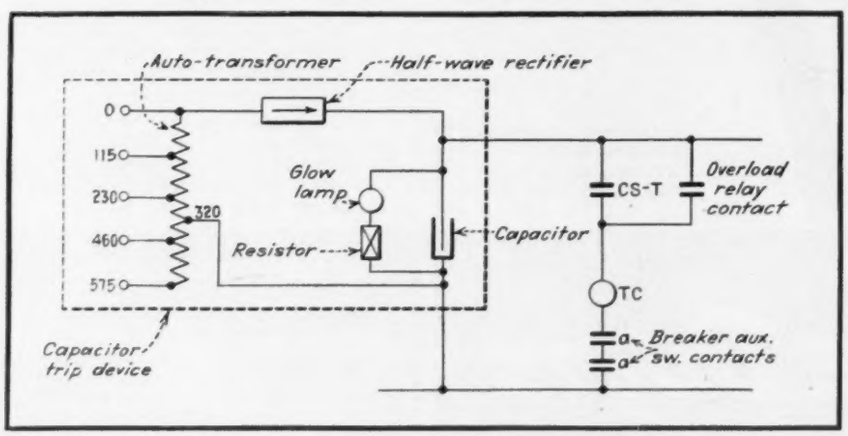
Ranking next in preference to battery is a method known as "capacitor tripping." This is very similar to battery tripping since it uses a shunt-trip coil which may be operated either from the manual control switch or from protective relays; thus it retains the relaying flexibility obtainable with battery tripping. The schematic diagram for capacitor tripping is shown in the illustration.

Tripping energy is obtained from a capacitor which is charged by a small half-wave dry-type rectifier, which in turn draws its energy from an auto-transformer. The auto-transformer may be connected directly or through a step-down transformer to the main a.c. circuit which the breaker is protecting. Several voltage taps are available on the auto-transformer as indicated; the correct one is selected so as to produce 320 volts a.c. for the device. When the overload relay operates on a fault, the capacitor discharges through the trip coil to trip the breaker. Even though the fault reduces the voltage to zero, sufficient charge is held by the capacitor to trip the breaker at least six seconds after the charging voltage is removed.

The low energy glow lamp connected in parallel with the capacitor provides visual indication of the charge on the capacitor since it glows at any voltage above 90 volts. When the supply voltage is removed, the resistor in series with the glow lamp will discharge the capacitor to 90 volts in approximately 60 seconds. However, it is wise to make sure the capacitor is completely discharged before handling, for its size is sufficient to deliver a considerable shock.

Thus, capacitor tripping is essentially the same as battery tripping; the battery is merely replaced by the capacitor-trip device. However, except on very small breakers, it is necessary to use the light-trip attachment with capacitor tripping. The volt-ampere burden is no greater than for battery tripping, so that it is possible to trip on low primary currents, using standard relays and bushing current transformers.

*Ninth in a series of twelve articles which began in August 7, 1943, issue of "Electrical World."



SCHEMATIC DIAGRAM for capacitor tripping of circuit breaker

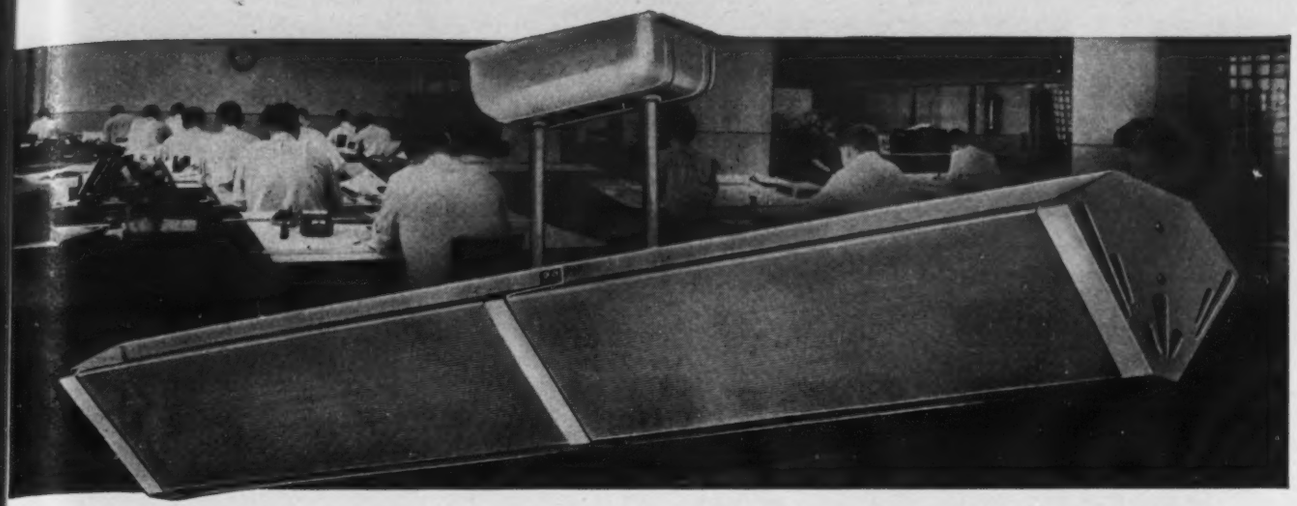
X-ray Diffraction of Power Plant Deposits

Instrumental analysis such as by X-ray diffraction tells a great many things about a power plant deposit which cannot be determined chemically. The most important attribute of the X-ray diffraction method is its ability to identify materials according to the chemical combination or crystal structure of the substance being examined.

The X-ray analysis differs from the chemical analysis in that no alteration is given the sample and the record (patterns) is permanent. In many ways the chemical analysis of a power plant deposit can be supplemented with considerable value by the report of an X-ray diffractionist, according to C. E. Imhoff and L. A. Burhardt (Allis-Chalmers Manufacturing Company) in a paper "X-ray Diffraction Methods in the Study of Power Plant Deposits," presented at a recent meeting of the American Society for Testing Materials.

X-ray diffraction patterns can be made by equipment consisting essentially of an X-ray tube, a source of high-voltage current, a circular camera having a sample holder in the exact center and a telechron motor for oscillation of the sample, and a film scale. Essentially what the X-ray does is to mark off on a circular film a series of linear distances which are related to measured interplanar distances.

One method of identifying compounds consists of placing patterns of two samples side by side so that their zero points coincide. If there is a sufficient number of lines from one pattern matching those of an-



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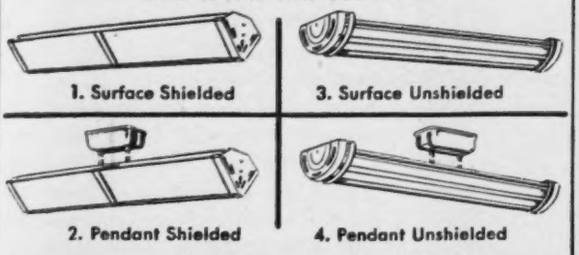
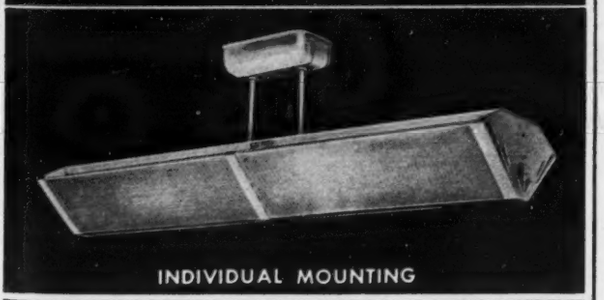


1. Surface Shielded
3. Surface Unshielded
2. Pendant Shielded
4. Pendant Unshielded

CONTINUOUS ROW MOUNTING



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Simple, smart, and modern in design, this new model is ideal for factory offices, drafting rooms, schools, and hospitals.

Its semi-direct light distribution provides real visual comfort through shadowless and glare-free illumination.

Light in weight, easy to install and maintain, it has a relatively small load (200 watts), which is seldom heavy enough to require the rewiring of existing circuits.

And you get a complete, pretested package of light — with 40-watt Sylvania Lamps, Mirastat Starters, and high-power-factor Dualamp auxiliary — completely wired and ready for installation.

This model — unshielded C-200R and shielded C-201R — is available to you on a priority of A-1-J or better, with specific WPB approval required for continuous row installations. It carries Underwriters' Laboratories inspection label and Sylvania's own guarantee. Write for further details, specifications, and prices.

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other, and in the same orders of intensity, then that compound is present in both samples. Following are some compounds identified:

Typical crystalline constituents of power plant deposits identified by the X-ray method are acmite, brucite, calcite, hematite, metallic copper, noselite, quartz, serpentine and xonotlite in boiler scale, corrosion deposits, softener sludges, feed line deposits; bohmite in oil filter floc; bunsenite, chalcocite, halite, opal and thenardite in turbine blade corrosion and deposits; calcium aluminate in softener chemical tank; ferrous oxide in superheater; gypsum in evaporator tubes; metallic silver in dezincified silver solder; tenorite in ejector trap corrosion deposits; whitlockite in phosphate line at boiler drum; wollastonite in ignited xonotlite boiler scales.

Minimum Percentages

The X-ray analysis can be used to some degree in making a quantitative estimation, provided the mixture is not a complex one. The method is not good for determining small amounts. Minimum percentages of material that can be detected in a sample may vary between 1 and 30 percent, depending upon the atomic number of the elements in the compounds and upon the degree of crystallization. Special techniques, such as leaching and ignition, may be employed to produce a considerably greater sensitivity in the identification of the smaller percentages.

The most valuable information to be obtained is that of positive identifications. In certain cases, however, negative identifications are of some value. Negative identifications are frequently made on turbine blade deposits, particularly on those containing amorphous silica.

Boost Boiler Rating by Changing Fuel

A complete change from stoker to gas firing in 1942, employing used equipment throughout, permitted the Oklahoma Gas & Electric Company to increase the steaming rate of a 300-psi. boiler at one of its plants from a top of 60,000 lb. per hour to a sustained rating of 75,000 lb. per hour.

In making the change the existing

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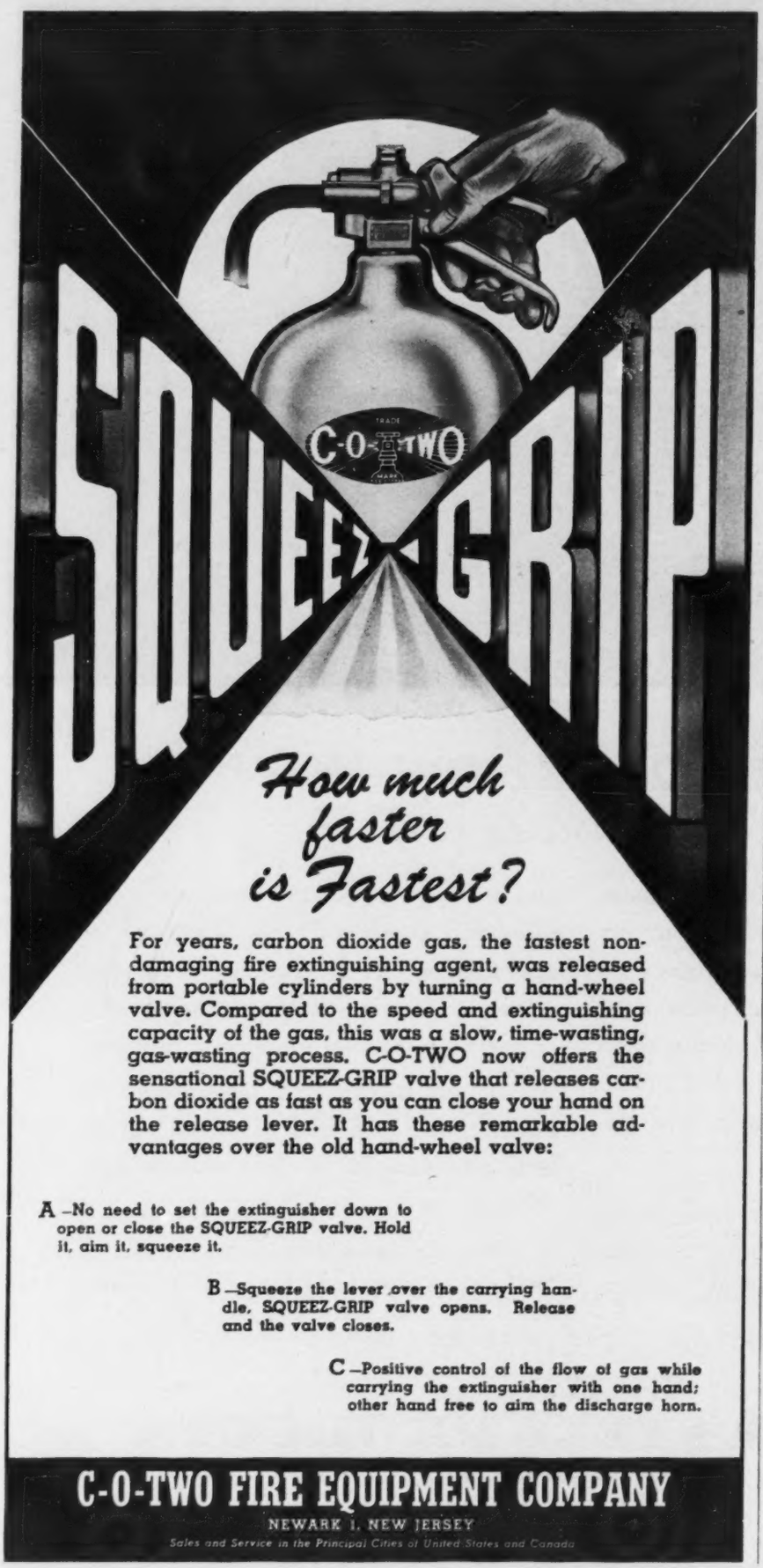
SQUEEZ-GRIP
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How much faster is Fastest?
For years, carbon dioxide gas, the fastest non-damaging fire extinguishing agent, was released from portable cylinders by turning a hand-wheel valve. Compared to the speed and extinguishing capacity of the gas, this was a slow, time-wasting, gas-wasting process. C-O-TWO now offers the sensational SQUEEZ-GRIP valve that releases carbon dioxide as fast as you can close your hand on the release lever. It has these remarkable advantages over the old hand-wheel valve:
A—No need to set the extinguisher down to open or close the SQUEEZ-GRIP valve. Hold it, aim it, squeeze it.
B—Squeeze the lever over the carrying handle, SQUEEZ-GRIP valve opens. Release and the valve closes.
C—Positive control of the flow of gas while carrying the extinguisher with one hand; other hand free to aim the discharge horn.
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Sales and Service in the Principal Cities of United States and Canada

underfeed stoker, including tuyeres, rams, feed wedges, etc., were removed and sheet metal spread over the stoker frame and covered with refractory. Four spare Peabody burners, complete with all secondary plates, piping, valves and regulators from another plant, were installed to burn the natural gas with a heat content of 1,100 B.t.u. per cu.ft.

While the same furnace volume was obtained after the change as when the stoker was used, a somewhat higher boiler efficiency was obtained with gas firing due to a reduction in slagging.

That WPB approval was obtained for the change is credited to the fact that no new critical material was needed.

•

Cabinets Reduce Cost of Control Wiring

By J. B. STRATFORD
Bureau of Power & Light
Los Angeles, Calif.

Flexibility in control circuits of the Bureau of Power & Light's major stations has for many years been an important factor in design. To accomplish this it has been the practice to terminate all important control wires on terminal studs at both the switchboards and at field equipment locations. Test terminal links are installed at each end of the control cable, showing the wire and conduit number stenciled thereon. These links provide ready means by which the wire can be opened at both the switchboard and equipment ends for testing purposes.

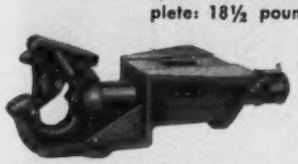
Panels on which the terminals are located are mounted immediately below the switchboards, as shown in the illustration on page 96, and close to the equipment at the field end. This particular view shows the construction below the main control switchboards of the Bureau's new Harbor steam plant. This is typical of construction used throughout the system. Terminal panels are constructed of ebony asbestos with barriers between units and contain brass studs and copper test links.

This type of construction not only serves as a junction point between the incoming lead-covered control cables from the field and the flameproof switchboard wire, but also ma-

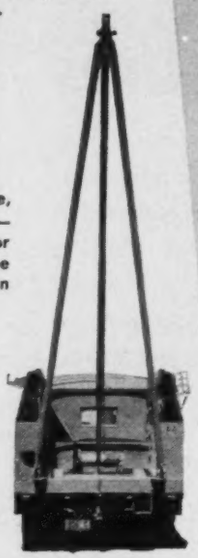
FWD LINE CONSTRUCTION AND MAINTENANCE EQUIPMENT THAT CONSERVES CRITICAL TIME AND MAN-POWER

Model 1775 Pole Trailer Especially adapted for high-speed hauling of poles over short and long distances. Because of its wide tread, this unit trails at high speeds without snaking or whipping. Light in weight, two men can easily lift it onto a truck when moving from one operation to another.

Sure Binder (Handiest tool you ever used) The Sure Binder is a portable hand winch for binding bulky loads of all types. Ratchet type drum holds 18 ft. of 5/16 inch cable. Weight complete: 18½ pounds.



Utility Pintle Hooks Provide a sure, safe connection between truck and trailer — any make of truck. Available in sizes for pulling loads of 1 ton or less and up to the universal type for towing anything that can be moved.



A Type Pole Derrick Made of the best seamless steel tubing properly heat treated. Available in sizes to handle poles from 25 ft. to 70 ft. in length.

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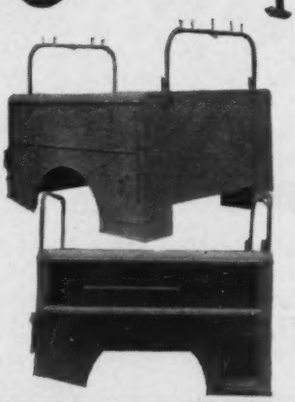

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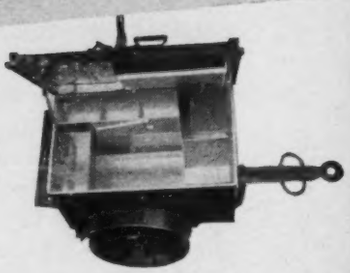
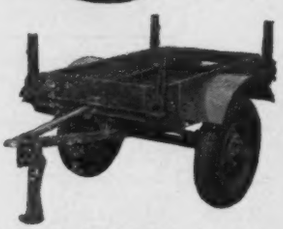


Cable Splicer's Cart—Model S All steel construction—compact—rugged—theft-proof. Compartments for every tool. Folding support leg. Capacity 1000 lbs. Available with either solid or pneumatic tires.

Combination Cable Reel and Pole Trailer This unit has electric steel spoke wheels of integral hub type. Timken roller bearings, and special heat treated chrome vanadium steel springs. All castings are electric steel cast. Axle material is 40-50 carbon steel, specially heat treated. The main frame and cross member 4", 9½ lb. I-beam. All trailers furnished with one set of pole hauling bolsters, and one set of cable reel saddles.



Combination Cargo and Pole Trailer

P8T Series. Available in heavy load capacities of 3100 to 8200 lbs. Extension tongue permits hauling of poles up to 40 ft. Optional electric brakes, side boards, stanchions, etc.

B-6 All Purpose Body

A light weight compact all steel body designed for installation on any half ton chassis. Complete unit weight does not exceed 600 lbs. Storage compartments contain over 54,000 cubic inches. Full height clothing and material compartment. Corrugated steel floor, reduced weight increased strength. Full standardization of design permits easy replacement of damaged body parts or complete sub-assemblies. Tail gate can be secured at 45 degree position, level with floor or fully dropped. Rear ladder bracket removable. Telescoping door stops and solid wood insert converts upper rite door to full length work table and vise holder.

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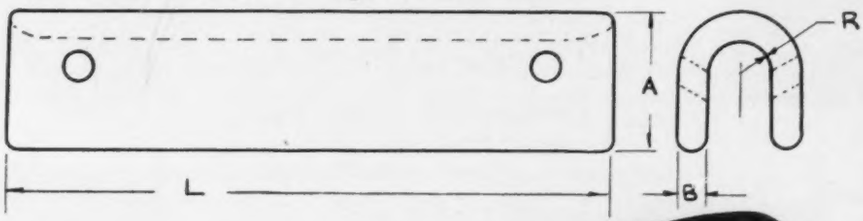
The largest of the new units will handle wires or lead-covered cables up to 1½" in diameter. The smallest size unit takes cables up to ½" in diameter and is of lighter weight construction. Dimensions of all of the four units are shown in the table below. All are made of Pinco high test porcelain and are designed to give maximum permanent protection, replacing other types of tree insulators. Write for complete information.



CATALOG NUMBER	DIMENSIONS A	B	R	L	MAX WIRE SIZE INCHES	WEIGHT IN LBS	INCH LBS IMPACT	NUMBER IN CARTON
* 3850-L-12	2⅝"	9/16"	3/4"	12"	1.5	3.75	60	12
* 3850 L-16	2⅝"	9/16"	3/4"	16"	1.5	5.0	60	12
3600 L-12	2⅝"	9/16"	½"	12"	1.0	2.75	60	12
3600-L-14	2⅝"	9/16"	½"	14"	1.0	3.25	60	12
3600-L-16	2⅝"	9/16"	½"	16"	1.0	3.75	60	12
3857-L-12	2"	3/8"	9/32"	12"	.5	1.5	45	36
3857-L-16	2"	3/8"	9/32"	16"	.5	2.0	45	36
3859 L-12	1¼"	¼"	9/32"	12"	.5	.75	35	48
3859 L-16	1¼"	¼"	9/32"	16"	.5	1.0	35	48

The PORCELAIN INSULATOR CORPORATION
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PINCO INSULATORS

Pinco Standard Insulators are cataloged in the Electrical Buyers' Reference.

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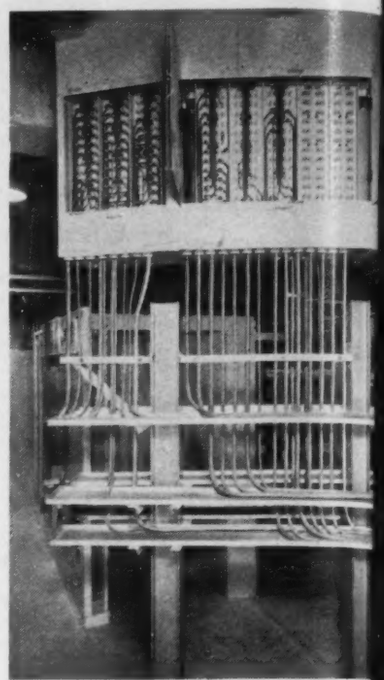
terially reduces cost of construction since the switchboards are wired in the construction shops. The wired switchboards are shipped to the job with sufficiently long pigtails to reach the terminals mounted directly below the boards. This minimizes the actual field wiring, and materially reduces construction costs. The lead-covered control cables coming in from the equipment in the field are



COST of switchboard wiring and maintenance of control circuits reduced by terminating circuits in standardized cabinets provided with test links

supported by structural steel "H" sections carrying galvanized iron trays from the conduit terminus to a location immediately below the terminal cabinets. Maple cable cleats are used to support the cable risers from the trays to the terminal cabinets.

This type of construction is employed not only on switchboards, but also on relay panels and major control distribution points as well. Immediately behind the cable trays may be seen the relay panels with the terminal cabinets which house terminal panels and test links of the same type as used under the switchboard. Standardization of the sizes and arrangement of terminal panels provides the utmost flexibility for construction, maintenance, and testing of the bureau's generating plants and major stations.

If your present manufacturing operations or postwar plans involve product parts where high dielectric and mechanical strength is essential, consult Westinghouse.

Skilled Micarta engineers will be glad to study your product . . . analyze its applications . . . give you the benefit of 35 years' experience with industrial plastics.

This experience is particularly extensive with respect to applications where effective insulation is necessary . . .

FOR EXAMPLE, IN THE MANUFACTURE OF RADIO EQUIPMENT for the Army and Navy . . . tube sockets, coil forms, variable resistor housings and terminal strips are all made from Micarta plate and tubing.

ON FIGHTING SHIPS . . . Micarta panels are used in circuit breakers that control gunfire equipment . . . in cable cleat blocks used to separate power cables from bulkheads.

AND IN MANY OTHER INDUSTRIES . . . hundreds of thousands of Micarta parts are used where dielectric strength and dependability are vital.

In many of these applications Micarta has replaced unavailable critical materials and is serving better, due to its unusual properties. It's a fact, for instance, if you were to wear Micarta "gloves" ½" thick, you could stand on wet ground and safely handle a high tension wire carrying 250,000 volts.

For complete Micarta data, phone your nearest Westinghouse office or write to Westinghouse Electric & Manufacturing Company, Dept. 7-N, East Pittsburgh, Pennsylvania. J-06340

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Aircraft structural parts	Protective helmet liners
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✓RIGHT in ALL WAYS

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Improved Heat Bakes Speedometer Bezels

In an Eastern factory producing aried war material the baking of namel on speedometer bezels is ef-ectively handled by an installation of 3 250-watt type R-40 infra red lamps paced 5½ in. on centers and mounted 5½ in. above the work. These trims" are of steel ring-shaped 5 in. diameter x ¾ in. thick, weighing 40 rams each, and the process consists f applying one coat of clear primer fter chromium plating and buff-g), followed by two coats of en-mel. The primer is sprayed on by nd and is then baked for seven inutes under the infra red at 250 eg. F. The second of the enamel oats is followed by another seven-inute bake at 250 deg. Formerly e job took an hour in an electric ven.

The installation was based on a test which the prime coat was baked on at distances ranging from 8 to 10½ in. above the work, the finish coat being baked at 8 and 7 in. distances. The trims were placed on a horizontal surface under a flat bank of R-40 infra red lamps arranged on an 8-in. triangular spacing. Here the drying times ranged from three to five minutes for the prime coat and from four to six minutes for the finish coat.

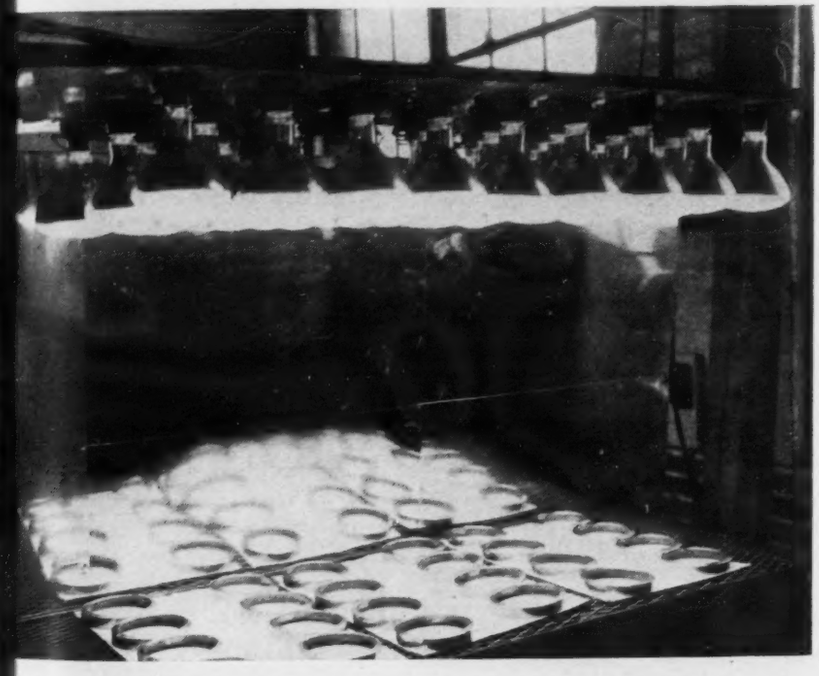
In the factory installation the R-40's were mounted on a zinc-lined base beneath a flat platform of five plywood sections, the platform being capable of being raised or lowered to vary the height above the work in case different jobs need servicing. The inside of the table is backed by sheet tin 3 ft. high and the bezels are placed on asbestos mats 36 in. above the floor. By lowering the lamp platform close to the work it is possible to apply temperatures of 600 deg. F. or over, but in the production line the bezel drying has worked out well with a separation of about 2 ft. between the lamps and the trims. Purchased energy services this factory.

Test Data

Ring No.	Prime Coat Time of Bake	Prime Coat Distance	Finish Coat Time of Bake	Finish Coat Distance
1	4 minutes	10½ in.	4 minutes	8 in.
2	5 minutes	10½ in.	5 minutes	8 in.
3	4 minutes	9 in.	5 minutes	8 in.
4	3 minutes	7 in.	4 minutes	7 in.
5	3 minutes	8 in.	*6 minutes	7 in.
6	4 minutes	8 in.	*7 minutes	7 in.

* Extra heavy coat of paint.

Note:—The distance in above table refers to mounting height of tip of lamp above flat surface on which trims were placed.



TTERY of forty-three 250-watt lamps dries prime and finish coats of instrument trims wo 7-minute periods, 24 trims at a time.

•

Chicago Launches a Swap Campaign

Chicago's Commonwealth Edison Company launched in October upon an electric appliance "swap campaign" patterned after the original Proctor Electric Company plan that is currently achieving startling success in its first try-out on the Duquesne Light Company system.

Under the plan appliance dealers offer war stamps in exchange for discarded, out-of-use electrical appliances turned in by the public. These appliances are reconditioned by the dealer and resold to alleviate the appliance shortage.

In its early stages dealer reception of the plan in Chicago has been encouraging. Two weeks after its introduction 219 dealers had signed up. Of these 170 joined up at one or the other of four meetings that introduced the campaign to various neighborhood dealers. Expectation is that upward of 300 dealers will ultimately participate, according to E. M. Ball, manager, dealer co-operation department, and campaign director.

Training of appliance repairmen for the dealers is being undertaken at no cost by the utility in its own appliance repair shop. The course will include classroom and demonstration work and upon its completion the "students" will be presented with a ten-volume set of repair manuals covering all phases of appliance repair technique.

It is to be particularly noted that while the Commonwealth Edison Company is sponsoring the "swap campaign" none of its stores will engage in the activity.

Spearhead of the co-operative drive

POOR VISION SURRENDERS
when you attack it with
Guth SUPER ILLUMINATORS
U.S. T.M. REG. & PATS. PENDING
The Newest and Best in
FLUORESCENT LIGHTING
Because of its unique design, the GUTH Super Illuminator is thoroughly rigid and durable, without violating any present-day metal restriction.
Stamped from a single sheet of steel, the Top Housing is attractive, simple, practical—a sleek, efficient unit that does the job right! The Masonite "Reflector Board" Reflector is formed in our own plant, and finished "300° White" for high lighting efficiency.
Attack darkness — the enemy of production—with light—with GUTH Super Illuminators! Write today for detailed Bulletin.
Leaders in Lighting Since 1902
Guth
THE EDWIN F. GUTH CO. 2615 Washington Ave. St. Louis 3, Mo.

is an advertising program in seven papers urging the public to turn in inactive appliances for stamps at local dealer stores. This will be followed by a weekly schedule. "Swap" ads will be placed in community and foreign-language papers in December.

In addition to newspaper space, the Chicago company is providing each dealer with up to 5,000 imprinted handbills at no cost, together with counter cards, window streamers and appliance tags. Car cards and billboard advertising has also been prepared.

Co-ordinated customer and dealer information service is an important feature of the activity. The utility is preparing a directory of participating dealers to assist customers in locating neighborhood dealers who are engaged in the swap activity. A consulting service is also being rendered to dealers on appliance repair parts. A card file of appliance trade names and corresponding manufacturers' names is being maintained for dealers. Manufacturers are being asked to notify the company: (1) If they have a supply of repair parts; (2) if the parts are for sale direct to dealers, and if not (3) what outlet is available to Chicago dealers for repair parts.

Dealers are also being furnished a list of other Chicago dealer firms participating in the plan so that repair work can be exchanged between dealers specializing in various types of appliances.

All appliances offered for resale under the plan are distinctively marked. Dealers have been supplied with a stock of tags which state that the appliance was purchased with war stamps and has been restored to usable condition.

Home Planners Seek Utility Aid

Southern California Edison Company, Ltd., was both surprised and gratified with public response to its offer to send free of charge the Edison General Electric Company's home planning file to any of its customers who planned to build homes. A small item in the utility's customer paper, *Electrical Times*, offered the file free to first comers. Immediate requests exceeded the 500 files on hand and an additional 3,500 lasted only a short

"...FROM THE HORSE'S MOUTH."

In addition to ultimate limits data, SHORT-TIME RATINGS for overloading are invaluable to us. Most of our equipment is protected with automatic alarm devices. If we know the duration of the overload period of a transformer, our men know how soon they must get to an overloaded transformer in order to avoid breakdown.

If we knew at what point the insulation starts to char, how long it takes for this to happen, we'd be much more able to load up equipment. Every big piece of equipment can withstand high temperature for a certain length of time. It takes some time before the high temperature has saturated the equipment to such a point that a rapid increase in temperature to the breakdown point occurs. We need that information today.

• • •

Can the transformer manufacturers tell us what accessories are available on various classes of DISTRIBUTION TRANSFORMERS? For example: are drainage plugs, filter-press connections, oil-sampling devices, oil gauges, thermometers, etc., included as standard equipment on distribution transformers of 50 kva and over or 250 kva and over? There is need for some clarification on this.

• • •

The above is an excerpt from the "E-A" Reporter, issued by the publishers of Electrical World.

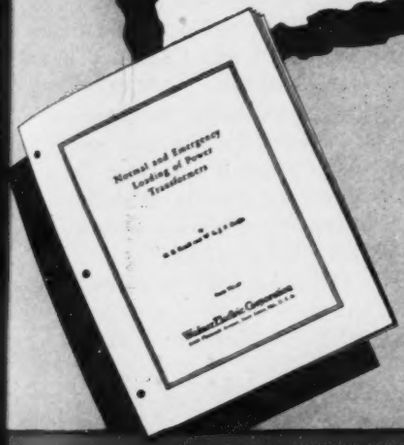
When Questions Like These Arise WAGNER Has the Answers

Answers to questions such as asked in the "E-A" Reporter are of vital importance to all transformer users.

Wagner Bulletin TU-40 on "Normal and Emergency Loading of Power Transformers" is a comprehensive treatise on the subject of transformer overload, and Bulletin TU-180 answers the questions of design and construction of distribution transformers, and also includes information on available accessories.

These bulletins have been edited by qualified transformer engineers, and are only a few of the many bulletins that should be in the hands of everyone responsible for the purchase, installation, and maintenance of transformers.

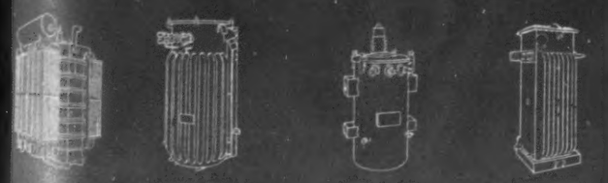
No matter what your transformer requirements may be, or what your transformer problems are, consult the nearest of Wagner's 29 branch offices, located in principal cities and manned by trained field engineers.



Send....

for your copy of Wagner Bulletin TU-40, on "Normal and Emergency Loading of Power Transformers". It is a valuable and convenient reference manual. Use coupon at lower right.

Wagner TRANSFORMERS



POWER • DISTRIBUTION • RURAL-LINE • NOFLAMOL

Wagner Electric Corporation

6456 Plymouth Avenue • St. Louis 14, Missouri

Gentlemen:

Please mail me my copy of Bulletin TU-40 ☐. I would also like to have Bulletins TU-180 on Distribution Transformers ☐, and TU-181 on Power Transformers ☐.

NAME _____ POSITION _____

FIRM _____

ADDRESS _____

CITY _____ STATE _____

T43-6

Rust
Can't Touch
HARPER
BOLTS
HARPER Fastenings resist rust, corrosion, salt laden air and other deep sea troubles. They're made of non-ferrous and stainless alloys. Today they are doing Trojan duty on battle ships, cruisers, aircraft carriers, PT boats, landing boats, submarines and many other types of vessels.
Because they are rust and corrosion resistant, Harper fastenings withstand severe conditions in the chemical, food, utilities and numerous other industries. In the proper alloys they are non-magnetic, non-sparking, repeatedly removable and have other sterling properties.
4320 STOCK ITEMS
. . . of bolts, nuts, screws, washers, rivets and accessories in the non-ferrous and stainless alloys.
THE H. M. HARPER COMPANY
2611 Fletcher St., Chicago, Illinois
BRANCH OFFICES: 45 West Broadway, New York City 7 • 1442 Broad Street Station Bldg., Philadelphia 3 • 332 I. N. Van Nuys Bldg., Los Angeles 14 • 2nd National Bank Bldg., Houston 2, Texas • 800 Broadway, Cincinnati 2, Ohio • 739 N. Broadway, Milwaukee 2 Wis. • Representatives in Principal Cities.
Brass
Bronze
Copper
Everdur
Monel
Stainless
HARPER
EVERLASTING FASTENINGS

time, leaving the supply exhausted and many still eager to receive this attractive and useful file. Plans to publicize the offer in small newspapers, of course, had to be dropped.

National advertising by Edison General Electric Appliance Company brought in 1,300 additional requests from Edison territory, making in all the names of 5,300 potential home builders on file. Southern California Edison plans to aid further these 5,300 customers with six weeks' mailings of suggestions for the file from lumber companies, manufacturers of building materials and plumbing, plastics and other supplies, and with reprints of articles in home planning magazines, etc.

H. C. Rice, Edison merchandise manager, estimates that post-war building in this territory will be at the rate of 25,000 homes per year and he plans to put a crew in the field and to offer the company's facilities to all customers who desire assistance in home planning and building.

•

Twenty Points for Post-War Planning

Specific suggestions on how to set up a post-war program were presented by S. P. Vecker, vice-president Carolina Power & Light Company, at the recent general sales conference of the Southeastern Electric Exchange. Mr. Vecker offered these twenty points "as an aid in preparing to meet the rapidly changing conditions during that most important period immediately following the war's end":

1. Designate one member of the organization or select a committee to handle the planning program.

2. Develop a tentative plan immediately, listing *first* things *first* to be done in the event the war comes to an unexpected conclusion.

3. Estimate the potential volume of industrial business which may be expected to continue unabated after the war.

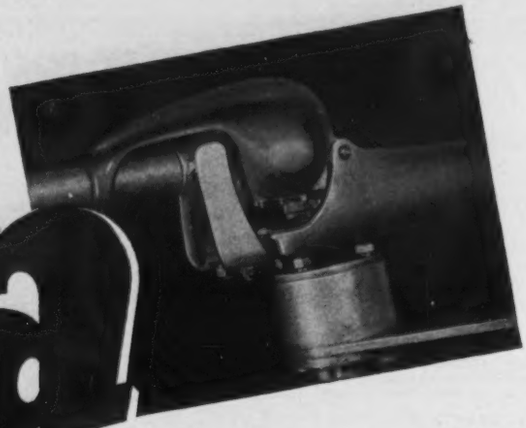
4. Estimate the potential volume of industrial business which you are reasonably certain will be lost as a result of canceled contracts.

5. Estimate the potential volume of industrial business that may be maintained or created through reconversion to peacetime production.

6. Study the possibilities of locating new industries for the purpose of

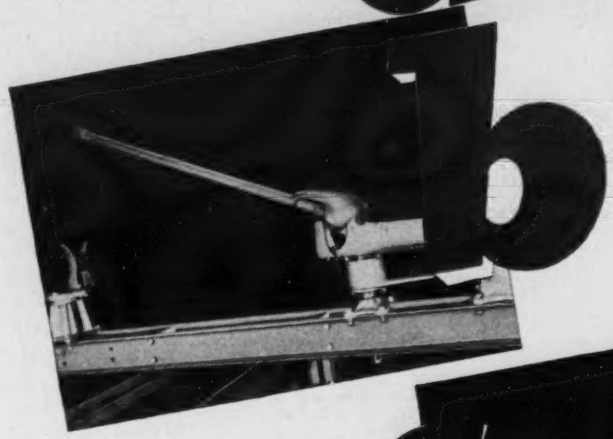
AS Simple AS a

Blade-actuating parts are completely enclosed... high-pressure contacts at both ends of blade... no shunts!



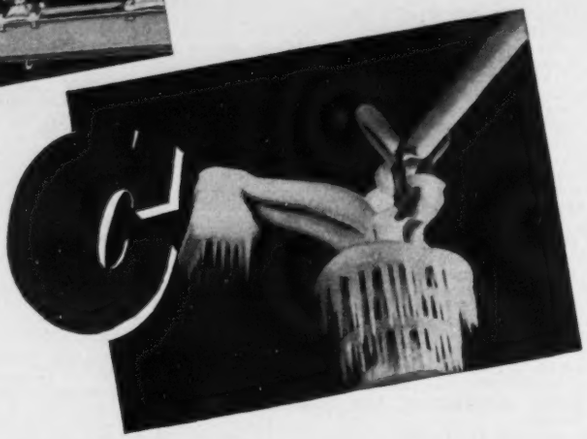
b

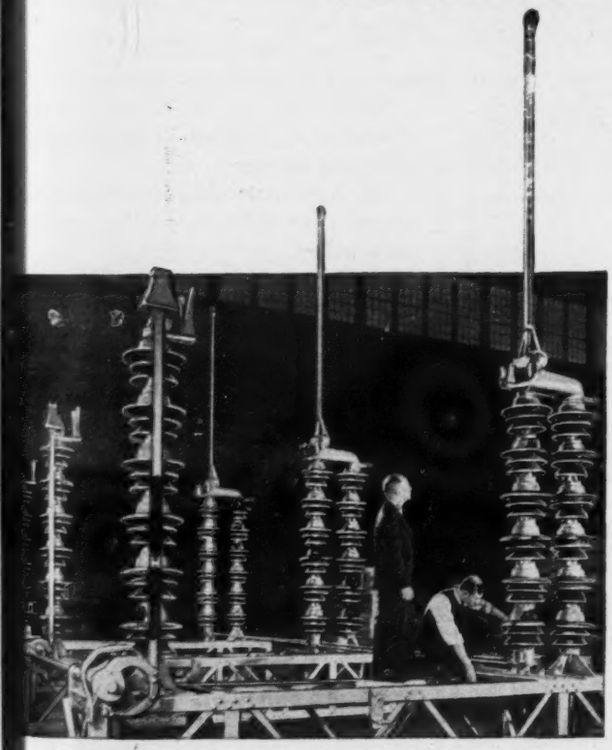
Blade rotation releases high-pressure contacts, leaving blade completely free *before* vertical movement. Counter-balance mechanism completely weather protected. Elimination of all sharp corners reduces corona.



c

Operates easily, even under ice conditions. Designed contours keep heavy ice from forming adjacent to moving parts. Cam-actuated blade twists readily, breaks ice that does form. Proved in 20-degree-below-zero cold room.





This type V outdoor group-operated disconnecting switch is available in ratings from 7.5 to 230 kv.

● THIS NEW HIGH-VOLTAGE OUTDOOR SWITCH HAS ONLY THREE MOVING LIVE PARTS PER POLE!

When a high-voltage main-line disconnect switch needs to open — it's got to open! And operate freely and smoothly, regardless of weather conditions.

Note how this new Westinghouse outdoor disconnect switch is designed with utmost simplicity to meet these requirements. There are actually only three moving live parts per pole.

The group-operated switch illustrated at left occupies as much space as a small house. It is typical of the skill and "know-how" that Westinghouse brings to all central-station problems. For complete information on indoor or outdoor switch equipment for any application, write Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N. J-60541

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

DISCONNECT SWITCHES

RECENT WILEY BOOKS *in*
ELECTRICAL ENGINEERING

YOU'LL find these recent Wiley books practical, authoritative and up to date. Whether you want a "refresher" or want to increase your knowledge—look over the Wiley books listed below. Select the books you need and mail the coupon now. Keep abreast of new developments in electrical engineering. Act today!

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By Russell M. Kerchner and George F. Corcoran
553 PAGES $4.75
Belongs on the bookshelf of every electrical engineer. In addition to the fundamentals, includes specialized topics as: energy measurements in polyphase circuits, electric filter theory, symmetrical components and short-circuit calculations.

2) ECONOMY LOADING OF POWER PLANTS AND ELECTRIC SYSTEMS
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An explanation of the fundamental theory of incremental rate and of its application in the solution of load-division problems encountered in the production and transmission of electrical energy.

3) MAGNETIC CIRCUITS AND TRANSFORMERS
By the Electrical Engineering Staff of the Massachusetts Institute of Technology
718 PAGES $6.50
A thorough treatment of the principles associated with the concepts of interlinked electric and magnetic circuits and their application to the analysis of transformers. Practical applications are made both to heavy-current power and light-current control, measurement and communications problems.

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By the Electrical Engineering Staff of the Massachusetts Institute of Technology
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For radio and communications engineers—up-to-date material on electron ballistics, electron emission from metals, electrical conduction through vacuum, gases, and vapors, high-vacuum electron tubes, vacuum tubes as linear circuit elements, Class A single stage amplifiers and those with operation extending beyond the linear range on the tube characteristic curve.

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Designed to give engineers a practical knowledge of electric motors as used in industry. Includes the characteristics and control of electric motors, electron tubes and electron devices, with numerous illustrations and examples of their uses.

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An invaluable source of practical material; helps electrical and consulting engineers to understand symmetrical and related components, and the solution of unbalanced power systems.

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A practical treatment of an important new branch of communications engineering for the electrical engineer. No special advanced knowledge on the part of the engineer is assumed.

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170 PAGES PROBABLE PRICE, $2.75
Power-plant operators, mechanical and electrical engineers will find this practical discussion on the selection and characteristics of turbines invaluable. *Ready in December.*

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Please send me on ten days' approval the books whose numbers I have circled below.

1—$4.75	6—$5.00
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ELECTRITE
A high grade fibre board for electrical insulation. A material of quality possessing high tensile and dielectric strength. Used by many of the leading manufacturers of electrical equipment.

DENSITE
An extremely hard board of superior quality which can replace the more expensive types of insulating materials.

Pulp Products Department
WEST VIRGINIA PULP & PAPER COMPANY

manufacturing products not formerly made in your area.

7. Be prepared to promote higher levels of street lighting to provide adequate safety under greatly increased traffic conditions.

8. Develop a plan for promoting adequate wiring among prospective modernization, expansion and new construction of all types of buildings, utilizing new ideas developed by National Adequate Wiring Bureau.

9. Study the possibilities of recapturing commercial load lost through business failures, restrictive orders and conservation programs.

10. Be ready with modernization plans employing many new services which will bring in new and additional revenue from commercial establishments.

11. Determine market possibilities among residential customers, listing outmoded or worn-out equipment which should be replaced following the cessation of hostilities.

12. Devise plans for the promotion of the sale of new and revolutionary equipment to residential customers.

13. Be prepared to construct immediately the hundreds of miles of rural lines which could not be built during the war because of restrictions.

14. Launch an agricultural development program designed further to enhance the economic status of the farmer.

15. Study the possibilities of maintaining present dealer outlets and the establishment of additional sources of appliance distribution immediately following the war.

16. Anticipate changes which conditions may influence in the over-all sales policy.

17. Draw a personnel chart for your post-war sales organization, indicating the number of positions which most likely will be filled by the return of former sales employees and develop plans for the immediate employment of new personnel.

18. Prepare sales training courses designed to cope with changed market conditions, employing such courses for instructing present personnel.

19. Anticipate the type of advertising and promotion required for one or two years following victory.

20. Project budget plans, making allowances if need be for further reduction in expenses between war's end and the time when reconversion will be completed and new products are ready for promotion.

IS Doubly IMPORTANT NOW . . . .

The excellence that has for many years distinguished Simplex insulated wires and cables has not been accidental. It was the natural result of careful supervision of materials and processes supplemented by both routine and special electrical tests during manufacture. Electrical tests are doubly important now because of restrictions limiting the use of scarce, critical materials.

If you are engaged in essential war work and need cables engineered to fit your operating conditions, it will be worth while for you to learn what Simplex controlled quality may mean for you.

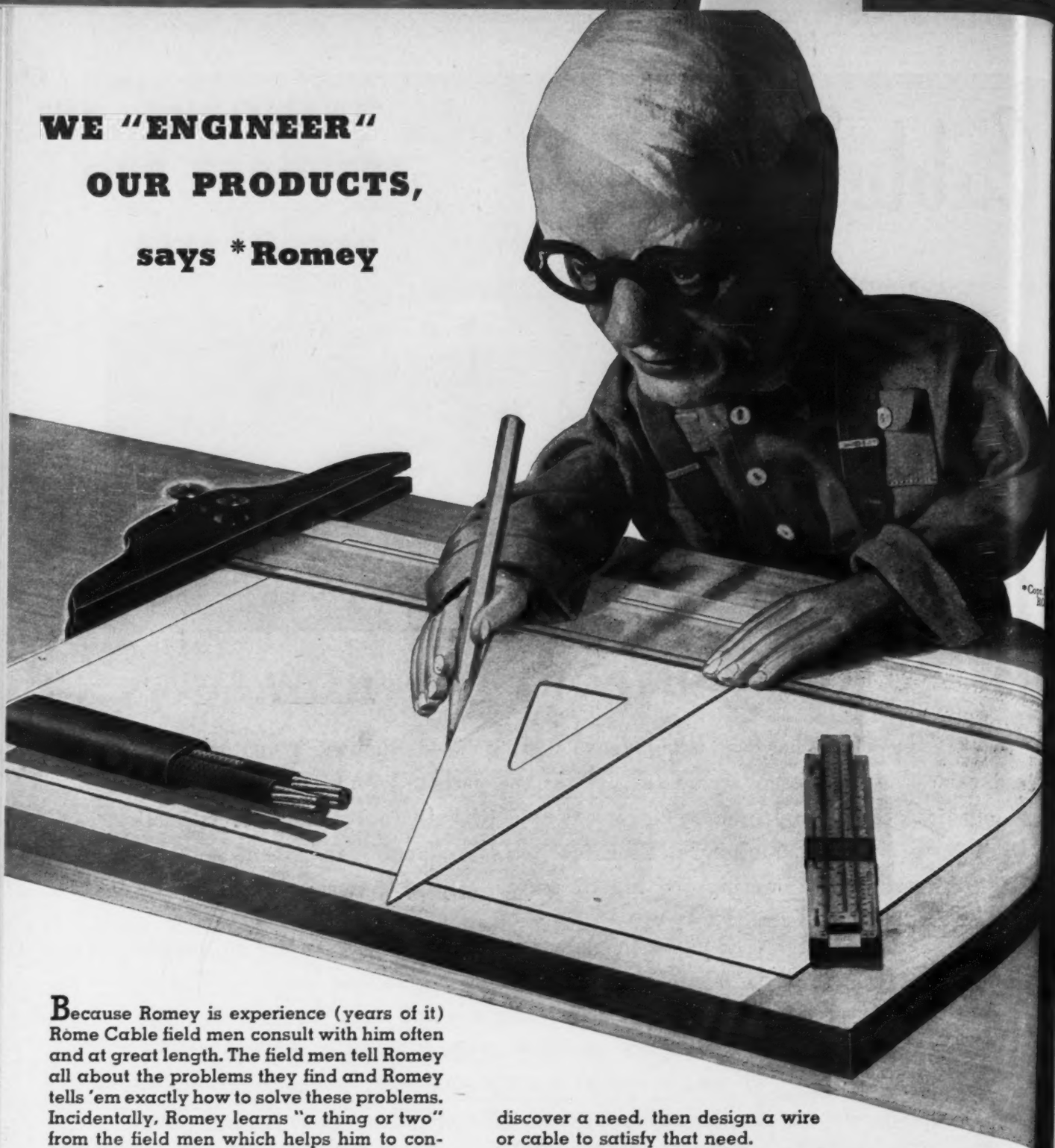
Simplex insulated wires and cables conform to government specifications and regulations but to maintain Simplex quality while meeting these unusual war-time limitations we have at times found it necessary to assemble special testing equipment for unusual, out of the ordinary, tests. The results have more than justified the extra work. Simplex quality is being maintained.

ARMY (E) NAVY

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

Simplex WIRES and CABLES

WE "ENGINEER" OUR PRODUCTS, says *Romey



Because Romey is experience (years of it) Rome Cable field men consult with him often and at great length. The field men tell Romey all about the problems they find and Romey tells 'em exactly how to solve these problems. Incidentally, Romey learns "a thing or two" from the field men which helps him to constantly improve production practices.

"Although we are very busy engineering and producing new war products, we always do our best to serve you," says Romey. "We discover a need, then design a wire or cable to satisfy that need.

"Right now we're awfully busy taking care of you as Uncle Sam directs but we're looking forward to the day when we can send you all the Rome Cable products you need."

FROM BAR TO FINISHED WIRE

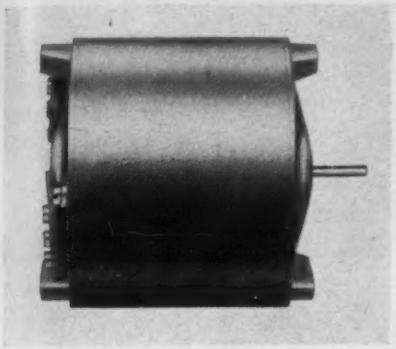
ROME CABLE CORPORATION

ROME • NEW YORK

NEW EQUIPMENT

Rotatable Transformer

A recent development in electronic control is the use of Telegon units as rotatable transformers where only extremely low torque is available. It is applicable for feeding a high frequency alternating current into the rotor excitation winding, and taking an induced voltage from the two-phase winding which varies roughly proportional to angular movement. This voltage is amplified and fed to a variety of devices. One application would be field control in an Amplidyne type unit.



Type "3155-971" Telegon unit; 110 volts, 400 cycles, input power 0.018 amp.; other units for operating on 26 or 85-volt, 400-cycle sources; weight 5 oz. **Kollsman Instrument Division, Square D Company,** 80-08 45th Ave., Elmhurst, N. Y.

•

Seam-Welding Gun

Portable seam welder; 100-kva., 440-volt, 60-cycle transformer; 2-hp., air motor, speed 48 and 52 in. per minute; gun throat depth 3 in., stroke 1½ in. with new wheels; water cooling 5 gal. per minute. **Progressive Welder Co.,** 3050 E. Outer Drive, Detroit 12, Mich.

Air-operated portable gun has been designed for seam welding steel up to two thicknesses of No. 20 gage, including stainless steels—parts that are too big to "take to the machine." The gun is universally suspended, can be swiveled for horizontal or vertical welding and the operation is controlled by a push button. Cable is 750,000 cir.mil. concentric kickless type. Transformer has dial switch for six stages of heat selection.

•

Kelvin Bridge

Model "K-1" Kelvin bridge; source voltage 0.5, 60 cycle, a.c. **Industrial Instruments, Inc.,** 156 Culver Ave., Jersey City, N. J.

Useful for routine measurements in production or in laboratory on low-resistance elements such as fuses, fuse clips, switch contacts, wire and bonds, new model of bridge has an electron-ray null indicator and a resistor decade with ten settings from 0.001 to 1.0. Over-all accuracy is said to be within plus-minus 2 percent for resistance values below 0.0005 ohm and plus-minus 5 percent for the lowest resistance, 0.0001 ohm, that can be measured.

•

Fire Extinguisher

Portable fire extinguisher is said to require only one hand for operation, other hand is free for precautionary measures. The operator grasps the arched-steel handle, while the thumb presses the trigger directly above, releasing a blanket of carbon dioxide through a fixed-position, fire-resistant horn.

Model "FF-4" carbon dioxide fire extinguisher; 4-lb. size. **Randolph Laboratories, Inc.,** 8 East Kinzie St., Chicago, Ill.

•

Rack Covering

"Koroseal RX" tape; glossy black; 1-lb. rolls, approximately 170 ft., ¾ in. wide, 0.014 in. thick. "Korolac RX," a solution of Koroseal; 1 gal. coats approximately 80 sq.ft.; film thickness 0.0015 in. when dip method is used. **B. F. Goodrich Co.,** Akron, Ohio.

Two new products for covering plating racks are made from Koroseal. They may be used separately. When used together the rack is first treated with two or three coats of the solution and the tape is then wrapped under firm tension, after which one or two more coats of the solution are again applied.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

•

Floodlight

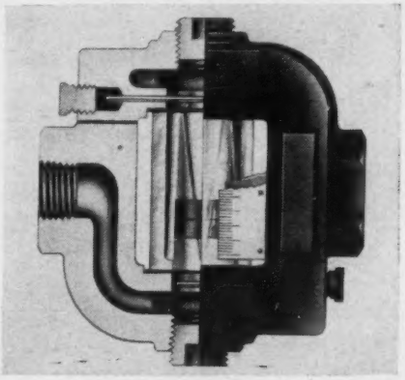
New heavy-duty steel floodlight, suitable for marine applications, has one-piece bullet-shaped casing. Reflector is held firmly in position inside the casing by means of a clamp ring assembly fastened to supports welded on the inside of the casing. Mounting for type L-29 is of swivel and rocker-type, with oval base, reinforcing plate and trunnion lug welded to the casing support; type L-30 has a trunnion bracket formed of channel section steel and an oval base mounting. Welded steel collar at the bottom of the trunnion bracket rotates on a spindle attached to the base.

Novalux Types L-29 and L-30 floodlighting projectors; 200- or 500-watt sizes. **General Electric Co.,** Schenectady, N. Y.

•

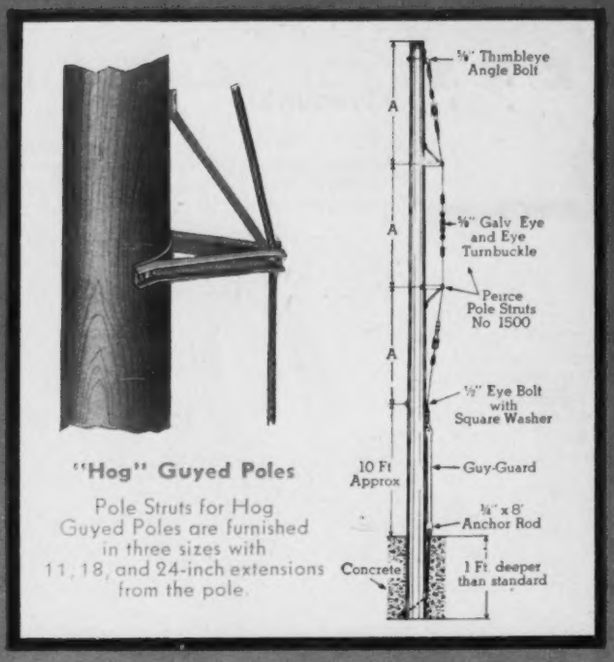
Flow Indicator

Sight flow indicator designed on Rotameter principle has an indicating float which moves up and down in a pyrex tube in direct proportion to the amount of flow. Instantaneous response to flow change is said to be obtained by the pyrex tube into which triangular V-ported flutes are formed. As a result a variable area meter is obtained giving a wide range over a short scale length. Magnetic float extension and switch provide high and low alarm positions.



"Rota-Sight" flow indicator. **Fischer & Porter Co.,** 122 County Line Road, Hatboro, Pa.

HUBBARD HARDWARE


⅝" Thimbleye Angle Bolt
⅝" Galv Eye and Eye Turnbuckle
Peirce Pole Struts No 1500
⅝" Eye Bolt with Square Washer
10 Ft Approx
Guy-Guard
¾" x 8' Anchor Rod
Concrete
1 Ft deeper than standard

"Hog" Guyed Poles

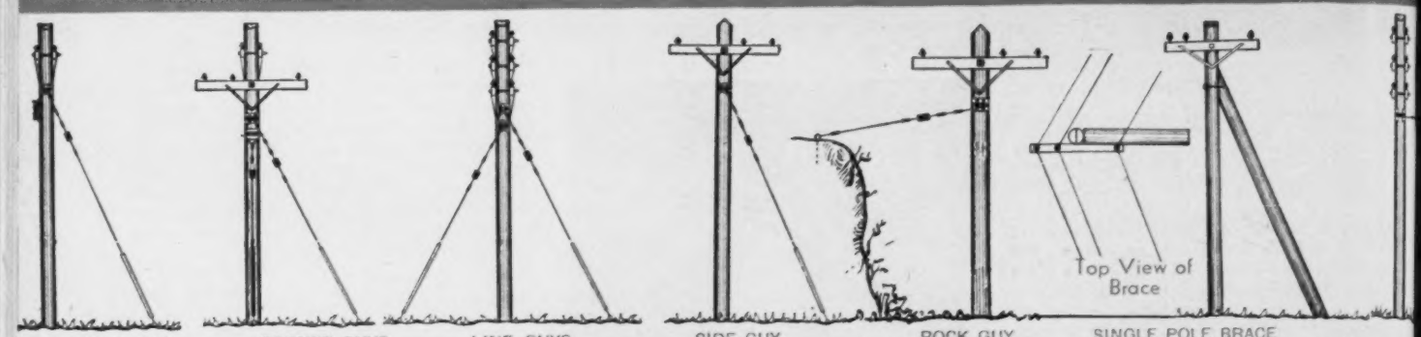
Pole Struts for Hog Guyed Poles are furnished in three sizes with 11, 18, and 24-inch extensions from the pole.

No. 6012
Angle Thimbleye Bolt
Furnished in sizes from ⅝-inch to 1-inch Diam. and 8-inches to 18-inches in length.

←For ½" Lags.
←For ⅝" Thru-Bolt
←For Guy Bolts up to 1 1/16" Diam.

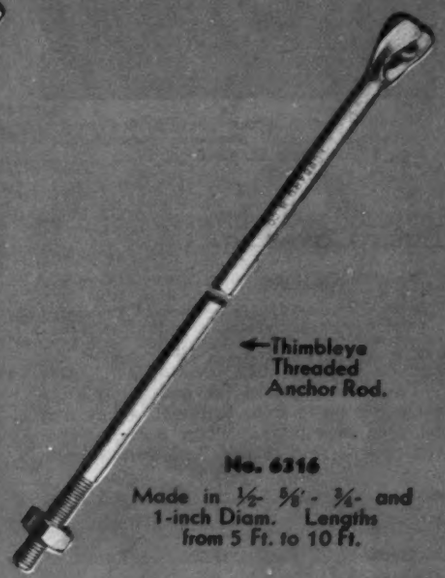
No. 8891 Load Plate
Furnished in several sizes and styles, curved and flat.

No. 7510 Thimbleye H
Sizes for ½- ⅝- ¾- and 1-i bolts, Double and Triple e

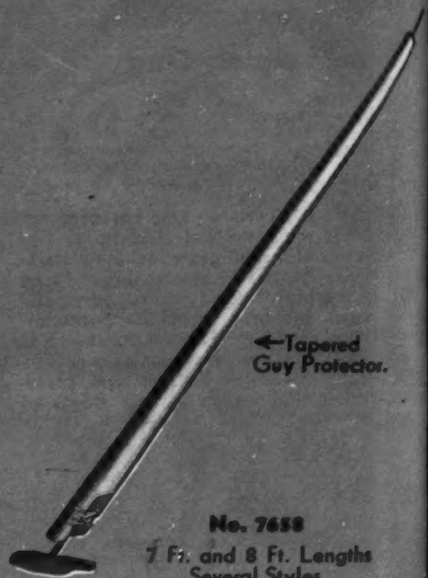


TERMINAL GUY | CORNER GUYS | LINE GUYS | SIDE GUY | ROCK GUY | SINGLE POLE BRACE

No. 7528
Steelwing Anchor
1½ Ft. to 8 Ft. Lengths.



No. 6316
Made in ½- ⅝- ¾- and 1-inch Diam. Lengths from 5 Ft. to 10 Ft.



No. 7658
7 Ft. and 8 Ft. Lengths Several Styles.

"Hang the Load on Hubbard Hardware"

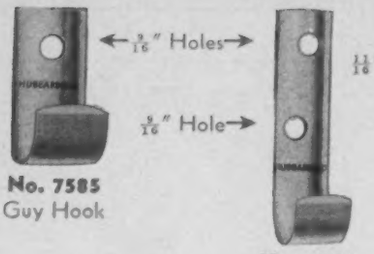
FOR ALL TYPES OF GUYS

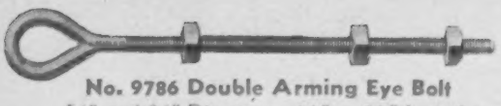
No. 7575 Strain Plate

Styles are plain and for Moulding. Also with Guy Hooks attached.

No. 7461 Guy Clamp

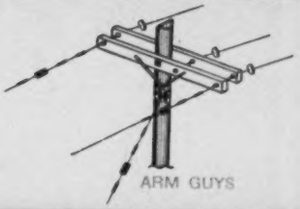
One, two, three and four-bolt styles for all standard strand.

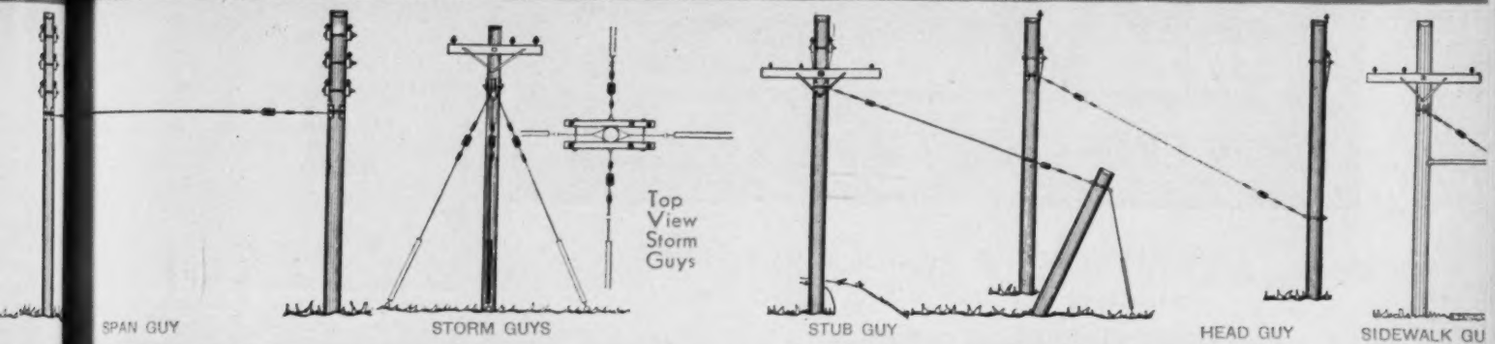


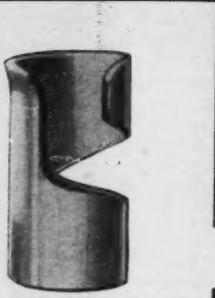


No. 9786 Double Arming Eye Bolt

5/8" and 3/4" Diameter—16" to 20" Lengths.



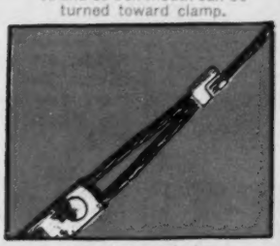




No. 7454 Servisleev

Sizes for Strand from 3/16" to 1/2" Diameter

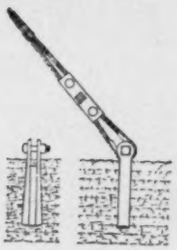
Servisleev is placed over strand so bell mouth can be turned toward clamp.



—Turned toward clamp bell mouth is driven over loose end of strand.

No. 7547 Rock Anchor

Installation of Rock Guy Anchor with Split End and Wedge.



No. 7545

Wedge and Shim Type Rock Guy Anchor.

No. 7595 Guy Thimble

Sizes for all standard strand and Anchor Eyes.

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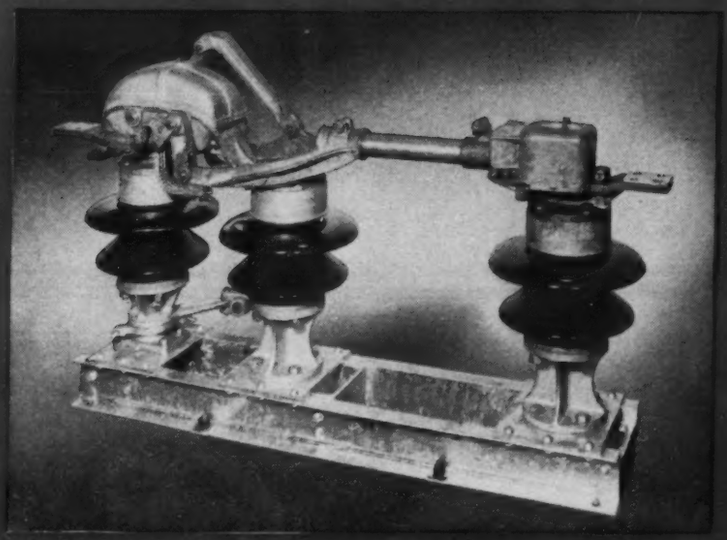
for Heavy Duty



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TECHNICAL LITERATUR

COPPER AND ALLOYS—A two-page sche ule on "Standard Commercial Wrou Coppers and Copper-Base Alloys" lists alloys which are believed to serve ordin ily most of the consumer requirements both war and peacetime products, and w materially simplify the preparation of en neering specifications. The schedule givi the name, composition and the forms g erally available, is obtainable from the C per and Brass Research Association, Lexington Ave., New York 17, N. Y.

FLOW INDICATOR—A 24-page publicati contains the theory of a flow rate meteri instrument, known as the Rotameter, a a viscosity conversion chart and explai the effect of float shape on fluid stre pattern, on differences in calibrations wh fluids of different viscosities are meter on flow coefficient, and effect of float de sity on correction factors for fluid dens changes. Bulletin, No. 98-Y, is availa from Fischer & Porter Co., Hatboro, Pa.

RADIO TUBES—A concise pamphlet cludes substitution charts for 150 and 3 ma. a.c.-d.c. receiver tubes, and batt tube types, listing first and second choi in possible replacements in an easy-to- check list. The pamphlet has been co piled by Sylvania Electric Products, In Emporium, Pa.

INDUCTION HEATING—"Preheating, We ing, Normalizing by the Alternating-C rent Induction Method" lists materials quired, methods of temperature indicati electrical information and discusses procedure for pipe heating and applicati in boiler and other shops. The illustrat publication may be obtained from Elect Arc, Inc., 152 Jelliff Ave., Newark, N. J.

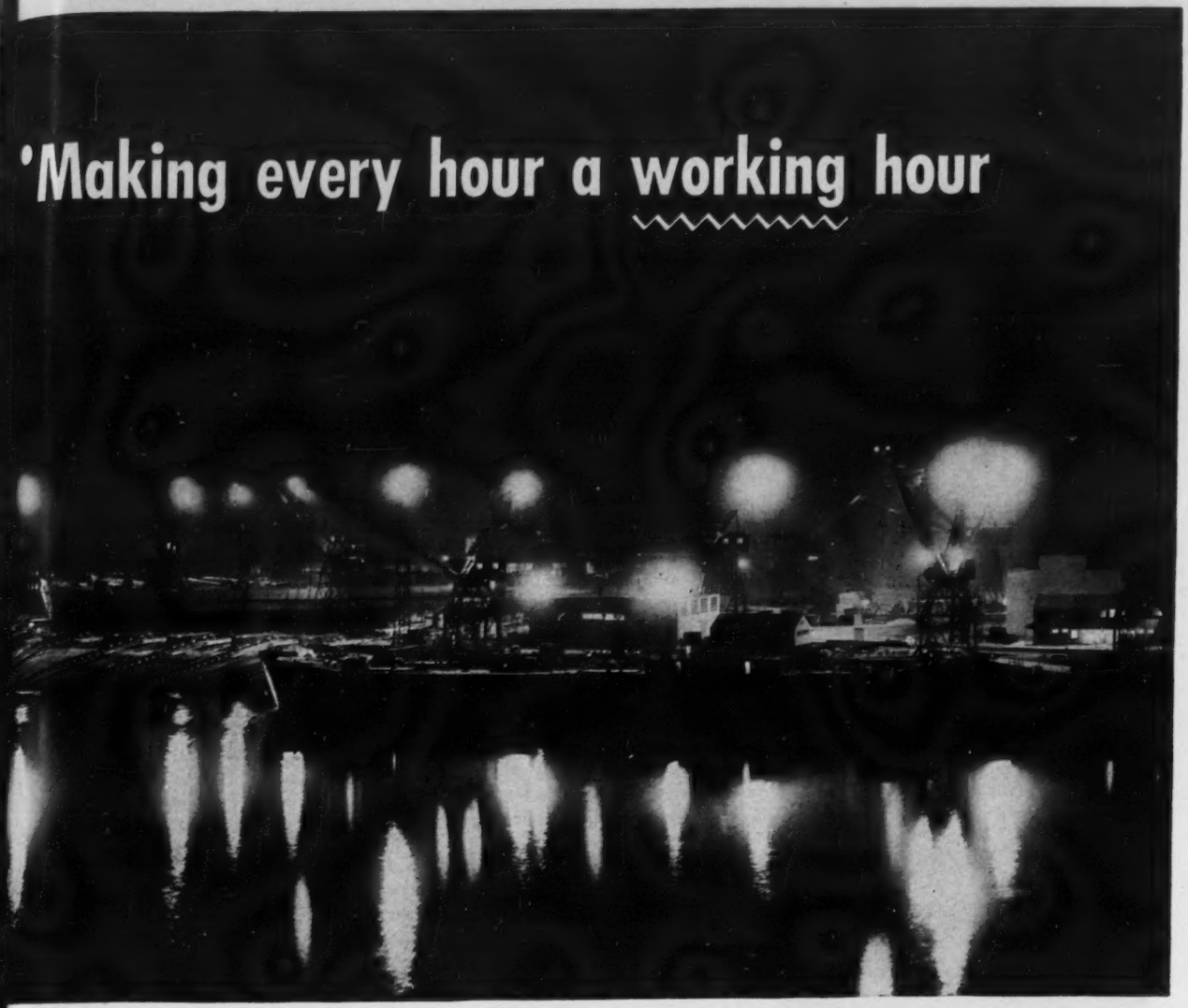
GASKET CHART shows cross-sections 36 popular gasket types, their purposes a the characteristics which fit them for s cific services intended. It is available fr the Goetze Gasket & Packing Compa Inc., New Brunswick, N. J.; requests to be made on your business letterhe mentioning your position.

WELDING FIRES—A 16-page, pocket-s booklet, "Preventing Welding and Cutti Fires," contains brief, clear discussions the chief causes of fires and practical, co mon-sense prevention measures, for instr tions to users of welding and cutting equ ment. Copies in reasonable quantities wi out charge may be obtained from the In national Acetylene Association, 30 East St., New York 17, N. Y.

INSTRUMENTS—A series of sketches of strument mechanisms, together with cuit diagrams and some data for use w lectures on indicating electrical inst ments, are presented in "The Instrum Sketch Book," available to instructors request to the Publicity Department, W ton Electrical Instrument Corp., News N. J.

LIQUID-LEVEL CONTROL—For all-elec floatless liquid-level control of any li that is an electrical conductor, the pr ciple and operation of an induction re used as a pilot device for a motor sta or other control, a description of electro automatic starter and relay combinati selector switches and panels, and two wiring diagrams of the most popular t of installations, are presented in a 28-p publication obtainable from B/W Cont ler Corp., Birmingham, Mich.

'Making every hour a working hour



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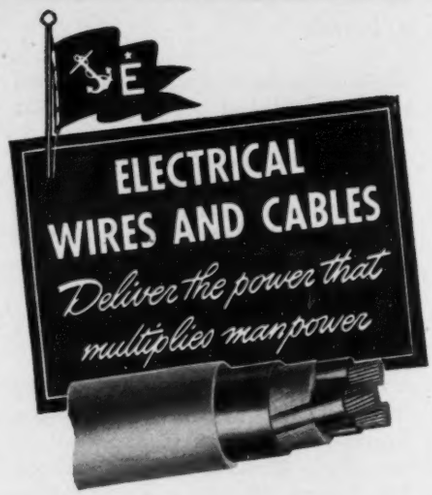

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NEWS ABOUT PEOPLE

Funk Assumes Executive Duties in Roanoke

M. C. Funk of Ashland, Ky., has been named vice-president and general manager of the Appalachian Electric Power Co., effective December 1, with headquarters in Roanoke, Va. The general offices of the Appalachian company will also be established in Roanoke on that date.

M. C. Funk

W. I. Whitefield of Roanoke will be promoted from assistant division manager to division manager of the company's Roanoke-Lynchburg division on December 1, succeeding John W. Hancock, who will remain with the company in an advisory capacity and as a director. The general offices of the division are in Roanoke.

G. L. Furr of Bluefield, W. Va., will be promoted from assistant division manager to division manager of the company's Bluefield division, succeeding Herbert Markle, who will remain with the company in an advisory capacity.

A native of Galax, Va., Mr. Funk has been connected with the Appalachian and predecessor and affiliated companies for 29 years. He began his service as superintendent of construction, later becoming general superintendent and then manager of the Tug River Power Co. in West Virginia. Subsequently Tug River Power Co. became a part of the Kentucky & West Virginia Power Co. Mr. Funk was then appointed manager of the Kentucky company, and in 1938 was promoted to vice-president and general manager of that company, with headquarters in Ashland, Ky.

Mr. Whitefield, who has been with the company for 28 years, began his service as power engineer at Roanoke and was successively superintendent of lighting and power, district manager and assistant division manager. He is a graduate of Virginia Military Institute.

Mr. Hancock, a director of the company, began his utility career in Roanoke in 1895. He was for a number of years general manager of both the Roanoke Railway & Electric Co. and the Lynchburg Traction & Light Co., later a part of the Appalachian system. In 1926, when the Appalachian company was formed, he became division manager of the Roanoke-Lynchburg division.

•

▶K. J. AFFANASIEV, formerly engineer for special studies, Pennsylvania Water & Power Co., Baltimore, Md., is on wartime leave of absence. He has taken the position of development engineer in the air-borne instruments laboratory of Columbia University, New York.

▶A. D. PETTEE, formerly district sales engineer, General Cable Corp., Chicago, Ill., has been made technical superintendent of the corporation's Bayonne, N. J., plant. Before joining the General Cable Corp., in 1929, he was associated with the firm of D. C. and W. B. Jackson (now Jackson & Moreland), Boston, Mass.; the International Harvester Co., Chicago, and the New York Edison Co.

•

Five Officials Promoted by Cincinnati Utility

Five executives of the Cincinnati Gas & Electric Co. have been given advancements by action of the directors of the company at its last meeting, it was announced recently by H. C. Blackwell, president of the company.

A. C. Moorhaus, vice-president, retains that position and becomes a member of the board. He joined the company in 1924 as purchasing agent, was appointed general manager in 1930 and made vice-president in 1938.

George F. Brenner, who has been treasurer, is now vice-president and secretary. He joined the company as assistant treasurer in 1925.

E. S. Fields, manager of the electric department, in charge of distribution and transmission, has been made vice-president. He started with the company at the power station in Newport, Ohio, in 1913.

D. S. Brown, manager of the electric production department, has been named vice-president in charge of that operation. He first was a boiler room foreman at the Plum Street power station.

William H. Zimmer, formerly assistant secretary and assistant treasurer,

EXECUTIVES IN CONFERENCE—Gathering for the first time since assuming their new positions are (l. to r.) E. S. Fields, George F. Brenner, William H. Zimmer, D. S. Brown and A. C. Moorhaus

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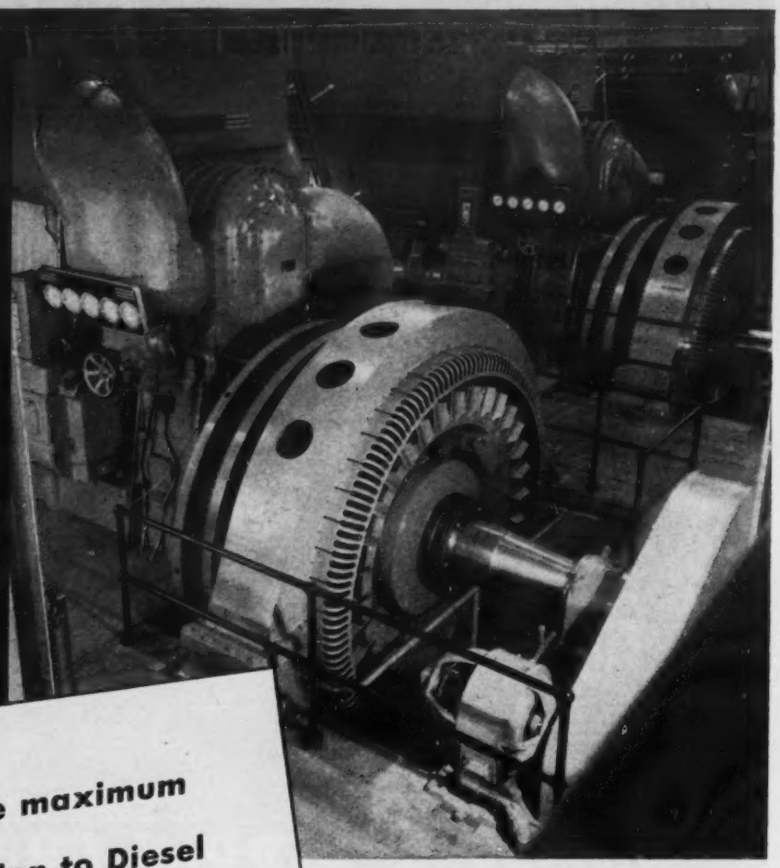

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has been elevated to treasurer, and retains his position as assistant secretary. He became identified with the Cincinnati utility as a messenger boy in 1920.

•

M. M. Greer Elected Wiegand Vice-President

Election of M. M. Greer as vice-president in charge of engineering of Edwin L. Wiegand Co., Pittsburgh, Pa., has just been announced. Mr. Greer joined the company in 1928 as an engineer in the experimental department after graduating from Massachusetts Institute of Technology and serving two years as a metallurgist in the steel industry.

H. R. Miles succeeds Mr. Greer as manager of industrial sales.

•

▶D. E. STEWART, formerly assistant manager of the western division of the Carolina Power & Light Co., has returned to the general offices in Raleigh, N. C., to assume the duties of assistant to Vice-President S. P. Vecker. Mr. Stewart will be in charge of the agricultural development and the rural phase of the company's business. Mr. Stewart has been with the company since his graduation from North Carolina State College.

▶L. J. BOURKE has been transferred from the position of western division manager of the Puget Sound Power & Light Co., at Bremerton, Wash., to the executive offices in Seattle. Beginning as a student engineer, Mr. Bourke has had 20 years of engineering experience with the company. He was resident manager at Elma in 1924, secretary to the vice-president from 1924-26, assistant to the executive vice-president from 1926 to 31, manager of the southern division at Chehalis from 1931 to 1934 and manager of the western di-

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sion since that time. He will be replaced as western division manager by J. HARVEY LEACH, advertising director of the company since 1936. Before going to the general offices Mr. Leach was manager for the company at Kent and later at Renton.

•

Safety Council Utilities Group Elects Officers

At the National Safety Congress held recently in Chicago the public utilities section of the National Safety Council elected the following officers for 1943-44: General chairman, E. S. Miner, American Telephone & Telegraph Co., New York, N. Y.; vice-chairman, J. T. O'Brien, Jersey Central Power & Light Co., Asbury Park, N. J.; secretary, J. O. Leslie, Gilbert Associates, Inc., Reading, Pa.

Chairmen of the various committees of the public utilities section were elected as follows: Engineering, W. R. Smith, Public Service Electric & Gas Co., Newark, N. J.; exhibit, J. P. McCann, New England Power Service Co., Boston, Mass.; film, C. N. Rakestraw, Cleveland Electric Illuminating Co., Cleveland, Ohio; health, Dr. Hart E. Fisher, Chicago Rapid Transit Co., Chicago, Ill.; membership, P. A. Alberty, Ohio Fuel Gas Co., Columbus, Ohio; news letter, E. L. Fitzgerald, Ohio Edison Co.; poster and safety kinks, George G. Waldrop, City Light and Water Utilities, Fort Wayne, Ind.; program, J. B. Porcher, Ohio Edison Co., Akron, Ohio; publicity, D. A. Fleming, Rural Electrification Administration, St. Louis, Mo.; statistics, B. A. Thornton, Indiana & Michigan Electric Co., South Bend, Ind.

•

▶ W. T. GRUMBLY, formerly engineer, Consolidated Edison Co. of New York, Inc., is on wartime leave of absence from that company. He is now employed as a field engineer, division of war research, Columbia University, New York.

▶ WILLIAM JOHNSTON has been appointed manager of the Thompson Falls power plant of the Montana Power Co., succeeding the late J. M. Frisbie. Mr. Johnston started working for the company in 1913 and was transferred to the Thompson Falls plant in 1924.

▶ JOHN B. ROSS, formerly with the Linde Air Products Co., has been appointed to the west coast engineering office of Handy & Harman. Mr. Ross will make his headquarters at the Los Angeles office, which serves California, Washington and Oregon.

J. A. Hutcheson Appointed to Research Position

John A. Hutcheson, for the past three years manager of engineering at the Baltimore radio division of the Westinghouse Electric & Manufacturing Co., has been appointed associate director of the Westinghouse Research Laboratories. Mr. Hutcheson's immediate assignment at the laboratories will be to direct wartime micro-wave research, but his scope of responsibility will include all phases of research engineering. Since joining Westinghouse, in 1926,

he has been in the radio engineering department of the company, first at East Pittsburgh, Pa., then at East Springfield, Mass., and finally at Baltimore.

Mr. Hutcheson was in charge of Westinghouse television development from 1938 until the war temporarily postponed that work. He also directed engineering for the Westinghouse X-ray division at Baltimore during the past year. Mr. Hutcheson was appointed to the National Television Standards Committee by the Federal Communications Division in 1939. He is serving the National Defense Research Committee as a member of the division which is doing ultra-secret electronics work under the direction of Dr. Karl T. Compton, president of the Massachusetts Institute of Technology. He is also a member of a special advisory committee appointed by Secretary of War Stimson for research and development on war equipment.

•

▶ J. CLYDE WILLIAMS, formerly apparatus and supply manager for the Westinghouse Electric Supply Co. at San Francisco, has been appointed manager of the company's branch at Oakland, Calif. HOWARD G. BROWN, formerly assistant to Mr. Williams, has been named to succeed him as apparatus and supply manager at the company's San Francisco headquarters. Mr. Williams has

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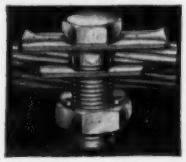
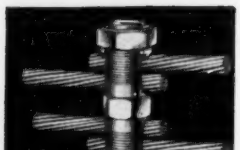
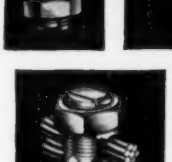
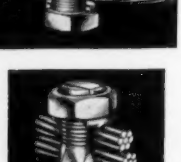








Also . . . the most complete line of Tee Connectors, Cable Taps . . . Straight, Parallel, Elbow and Cross Connectors . . . Bus Supports, Clamps, Spacers . . . Grounding Clamps, Terminal Lugs . . . practically every good type.

Leading utilities, industrials, electrical manufacturers and contractors have found that "*Penn-Union*" *on a fitting is their best guarantee of Dependability.* Write for the Penn-Union Catalog.

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

been identified with the electrical industry in San Francisco since 1906. Except for a year's military service in World War I, he served from 1912 to 1923 with electric supply firms which were purchased by Westinghouse in the latter year. He has been affiliated with Westinghouse since that time. Mr. Brown has been associated with Westinghouse Supply since 1923, when it purchased a San Francisco electrical supply house with which he had been associated for five years.

▶ W. H. Radeke has been appointed service manager of the Gould Storage Battery Corp., Depew, N. Y. Mr. Radeke, who will be in charge of servicing operations, has been a Gould service engineer in the Chicago area for the past seven years. For seventeen years prior to that he was active in the public utility field, specializing in lead acid storage battery service. Because of the wide experience he obtained in World War I in submarine storage battery operations, he will in the future personally contact east coast naval bases for installation work and service on Gould batteries in use by the Navy.

▶ Dr. Zay Jeffries, technical director of General Electric Co.'s lamp department, Nela Park, Cleveland, is the first recipient of the Gold Medal of the American Society for Metals. The medal, conferred at the 25th National Metals Congress, Chicago, was awarded Dr. Jeffries "in recognition of his outstanding metallurgical knowledge and his great versatility in the application of science to the metal industry." In addition to this award, the society's Albert Sauver Medal and the James Douglas Medal of the American Institute of Mining and Metallurgical Engineers have been presented to him. Dr. Jeffries is identified not only with General Electric, but also with the Carboloy Co. as chairman, with the Case School of Applied Science as a former faculty member and trustee, and as consulting metallurgical engineer for Aluminum Co. of America. He is a member of numerous technical societies, and as a lecturer is widely known in this country and abroad.

OBITUARY

▶ James M. Frisbie, 64, superintendent of the Montana Power Co.'s Thompson Falls plant since 1925, died in Missoula, Mont., on November 3.

▶ William H. Smith, for many years in charge of all assembly at the Locke Insulator Corp. plant at Baltimore, Md., died suddenly, on November 4. Mr. Smith originally joined the Locke organization in 1904, leaving in 1912 to build and operate the Canadian Porcelain Co., Ltd., Hamilton, Canada, returning to Locke in 1928. Mr. Smith was recognized as an authority on kiln structures and was widely known in the insulator industry.

▶ Monroe L. Bickart, founder, secretary and treasurer of the Electric Specialty Co., Stamford, Conn., died in St. Luke's Hospital in New York on November 12. Mr. Bickart was born in Pittsburgh 76 years ago.

▶ Albert V. Smith, 46, superintendent of buildings and power administration at the Massachusetts Institute of Technology, Cambridge, since 1929, died suddenly, on October 8. He was a native of Everett, Mass.

▶ Arthur C. Iremonger, superintendent of the commercial and distribution department of the Shawinigan Falls district of the Shawinigan Water & Power Co., died at his home in Shawinigan Falls on November 12, after a short illness. He was 59 years of age. Mr. Iremonger had been connected with the Shawinigan utility for more than 40 years.

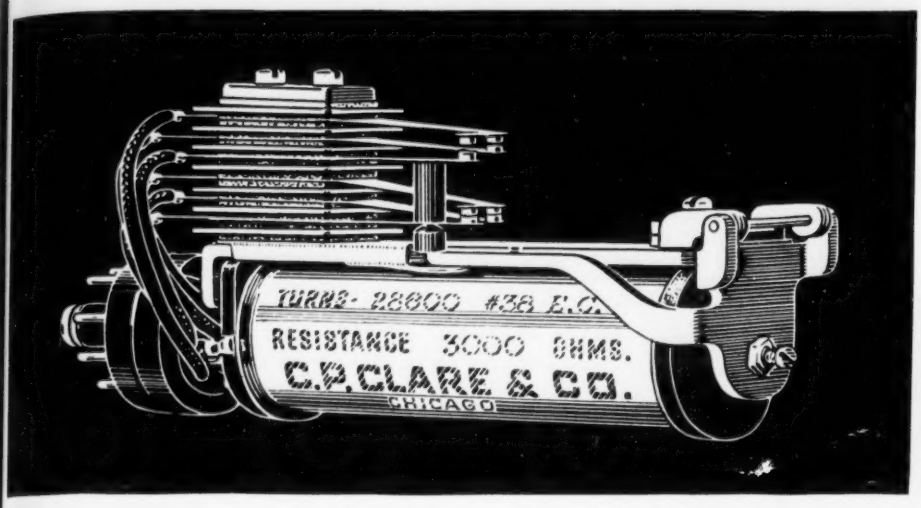
▶ Harry C. Merritt, formerly vice-president and general manager of the Allis-Chalmers Manufacturing Co.'s tractor division in Milwaukee, Wis., died on November 17, of a heart attack, at his farm home near Littleton, Ill. He was 62 years old. Mr. Merritt retired from the industrial field in 1941 because of illness. Just before retirement Mr. Merritt received the McCormick Medal from the American Society of Agricultural Engineers for "meritorious work in contributions to agriculture." In 1938 Mr. Merritt headed a committee of Wisconsin farm, industrial and business leaders, appointed by Julius P. Heil, then Governor-elect, to boost the state's products. He was born at Vermont, Ill., and he joined Allis-Chalmers as a branch manager in 1923.

▶ Arthur W. Turner, general manager of Andersen, Meyer & Co., Ltd., of Shanghai, China, died on November 12 aboard the exchange ship Gripsholm, according to word received from the State Department. He was 52 years old. Mr. Turner had been interned in China for nearly two years. He was born in Cedartown, Ga., and was employed by the General Electric Co. in Lynn, Mass., from 1911 to 1919. He became associated with Andersen, Meyer & Co., a subsidiary of International General Electric, in 1920. He served with the company in China until 1929, when he returned to the United States to serve as a mechanical engineer successively with Ford, Bacon & Davis, the Forstmann Woolen Mills and Jackson & Moreland. He went back to China for Andersen, Meyer & Co. in 1933.

Utilities Protect Plants with

CLARE "CUSTOM-BUILT" RELAYS

in Watchman Reporting Systems



When the watchman pushes the button at his control station, the signal is always registered when Clare Type C Multiple Contact Relays are on the job at the central station.

Many utilities are turning to Clare "Custom-Built" Relays for use in their plant protection program. Operating a remote station sends an electrical impulse which actuates the Clare Multiple Contact Relay at the central station. This operates a signalling or recording device. The circuit incorporating this relay may be so arranged as to provide other functional operations.

This is but one of the important uses for these dependable Clare Relays in utility service. Their ruggedness and long life recommend them for service in operating control panels, circuit breakers, network protectors and other equipment.

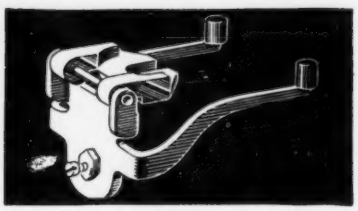
The Clare Type C Relay is "custom-built" to meet specific requirements. In it go the utmost in fine materials and precise manufacture. Some of the Clare features include:

Standard spring assemblies may embody any combination of five contact arrangements.

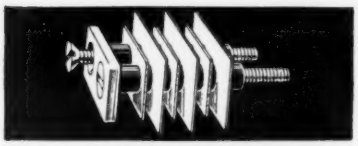
Coils are carefully wound to exact turns on precision machines. Lead-out wires are securely soldered. Coils are protected with a transparent acetate covering, and are available impregnated with special varnish.

Octal base plug mounting is illustrated. This makes for easy service and replacement. Other types of mounting, such as individual angle bracket, strip or panel, can be furnished.

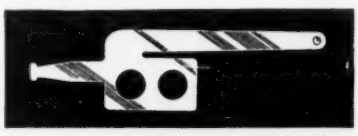
These features, plus the fact that all Clare Relays are carefully designed, well manufactured from best materials, and precisely adjusted, assure that this Clare Type C d.c. Relay will reduce overall relay cost, simplify installation and insure better and more dependable performance. Clare engineers are ready at all times to assist you in developing a relay specifically "custom-built" to meet your requirements. Send for the Clare catalog and data book. C. P. Clare & Co., 4719 West Sunnyside Ave., Chicago (30), Illinois.



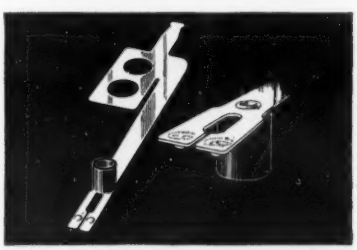
Double arm armature assembly of stainless steel shaft, operating in a marine brass yoke. Heelpiece, core and armature assembly of magnetic metal.



High voltage spring pile-up insulators of special heat treated Bakelite. Has minimum cold flow properties, low moisture absorption content, and permits punching without cracks or checks.



Contacts are welded to nickel silver springs by special process. May be of precious metals or alloys in 12 different standard, or special, types and sizes.



Spring bushing insulators are made of Bakelite rod under patented process. Resist vibration and withstand heavy duty service.

CLARE RELAYS

"Custom-Built" Multiple Contact Relays for Electrical, Electronic and Industrial Use

MANUFACTURING-MARKETS

Kelvinator Reports on Its War Effort

Nash-Kelvinator Corp. in a double-spread scheduled to run in leading weekly magazines, is interrupting its current advertising theme to bring the public up to date on the company's participation in the war effort.

Commenting on the war effort résumé, C. J. Coward, in charge of the corporation's current program, said: "Only a message of real significance would cause us to deviate even temporarily from our current advertising theme. The company has made such outstanding progress in war production since our last report to dealers and the public that we have selected the second anniversary of Pearl Harbor as the occasion to bring this story up to date.

Calling attention to some of the more significant accomplishments in war production made by the company since then, Mr. Coward pointed out: "Within the last several months Nash-Kelvinator has become one of the world's largest producers of aircraft propellers. The company has also received a contract to build Sikorsky helicopters for the Army air forces, and it has recently been announced that our 2,000-hp. supercharged Pratt & Whitney engines, used with such success on the Corsair, are also being used to power the Navy's newest and deadliest sky-fighter, the Hellcat. These and similar achievements are mentioned in this one-time insertion."

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Formica Discusses Post-War Program

While topmost efforts are being put forth to war production, D. J. O'Conor, president of the Formica Insulation Co. and nationally prominent in laminated plastics industry, told Formica representatives and engineers from all parts of the country assembled at a three-day war time seminar and post-war planning conference held recently in Cincinnati, that "a great future exists for application of wartime research to peacetime industrial and consumer needs."

The Formica research engineers, co-operating with suppliers of varnishes and resins, he said, "are working reciprocally to obtain advantages of minimum production costs and maximum utilization of basic raw materials."

John M. Byrne, economist of Cincinnati and economic adviser to the laminated plastic industry, in his address before the assembled Formica engineers and sales representatives, expressed the belief that despite the load of taxation and certain post-war adjustments, the pent-up purchasing power of the American people "will surge forth" to provide an unusually extensive boom.

Members of the Formica engineering department, under the direction of George H. Clark, vice-president in charge of engineering, conducted the engineering program. J. Roger White, vice-president in charge of sales and advertising, was chairman.

Discussions of special phases of the plant product and post-war applications were led by Mr. Clark, engineering problems; John Pitzer, glass fabric base materials; George Power, MF Grade; John J. Dreyer, forming sheet material; John J. Cochrane, Jr., post-war decorative materials, and D. J. O'Conor, Jr., new laboratory equipment.

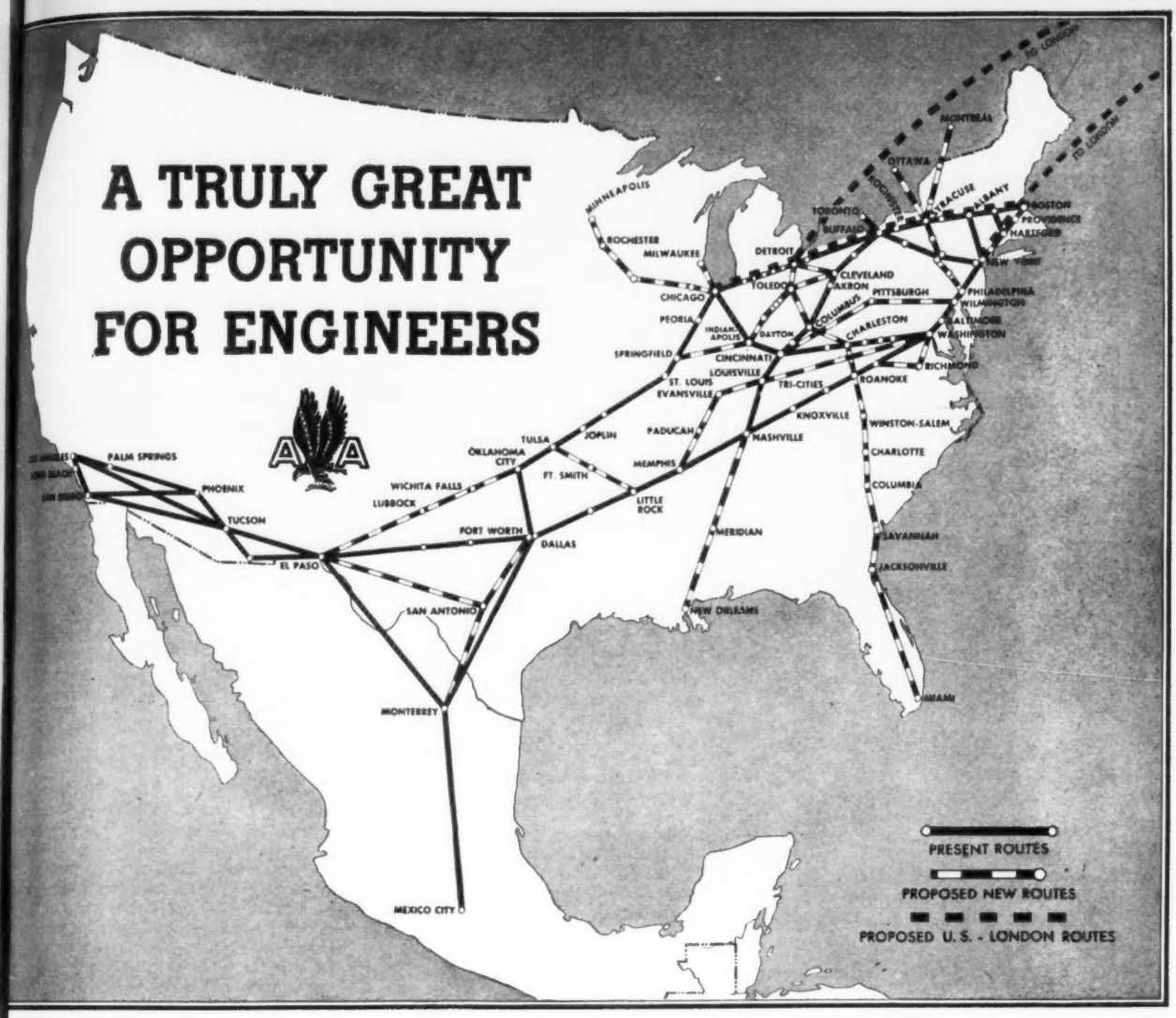
SAFETY IDEA—"Safety Always," the slogan of the all-out drive for safety in the plants of Landers, Frary & Clark, appliance manufacturers, is carried to every department on the specially constructed safety wagon. Paul McCoy, safety engineer, explains the purpose of the display, which contains such articles as face shields, gloves, boots, glasses and tools

•

Product Standardization Improvement Reported

Co-operation between U. S. and Latin American foreign trade committees studying standardization of industrial products to accelerate exchange of goods between "Good Neighbor" nations was reported well along by Herman Greenwood, vice-president in charge of the international division of Carrier Corp., in an address before the National Foreign Trade Convention at the Hotel Pennsylvania, New York.

The Carrier executive spoke as a member of the Committee on Inter-American Co-operation of the American Standards Association. "When standards are discussed and specifications are being drafted in any Latin American country," Mr. Greenwood said, "we endeavor to have the specifications, as adopted, read in such a way as not to exclude United States standard products. At the same time we try to have them drawn rigidly enough to exclude unsatisfactory or poor quality products. Sometimes our own standards are ex-



THE map shown above is more than a p. It is a picture of one of the greatest opportunities r offered to engineers. For it is the American Airlines tem map, showing the present and the proposed new utes of the Flagships.

The organization that operates passenger, mail and go airplanes over the current vast routes is seeking men positions in its Engineering Department at La Guardia ld in New York. Men sparked by vision and ambition l be quick to see that here is not only the chance to e an active hand in vital war work, but get a head rt toward a limitless peacetime future as well.

ir transportation is one business that surely is going to expand after the war. Here is your opportunity to help, and to grow with American Airlines.

Aeronautical experience is not required. If you have had at least two years of experience in the design or servicing of tools, machines or mechanical devices in mechanical, electrical or aeronautical fields, you can qualify. Candidates accepted will be given a full course in aircraft familiarization. Length of course and starting salary will depend on your experience.

Today, write the Personnel Department of American Airlines, Inc., at the address below, giving your past experience and detailed personal information, including draft status.

AMERICAN AIRLINES *Inc.*

PERSONNEL DEPARTMENT, SECTION "A," 100 EAST 42nd ST., NEW YORK 17, N. Y.

★

cepted. . . . We can only co-operate with the local organizations. We will give them all the assistance we can; we will suggest; we will endeavor to explain our own experience. But, in the last analysis, it is a matter of co-operation with our neighbors . . ."

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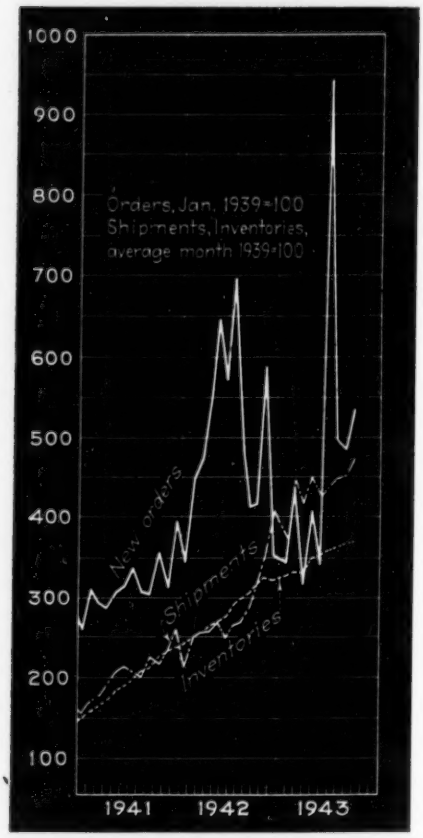
Electric Machinery Orders Advance

New orders received by manufacturers in September increased about 3 percent from August, although the September volume was still considerably below the June peak. The entire increase occurred in the durable goods industries, with the electrical machinery



ELECTRICAL MACHINERY INDICES of Bureau of Foreign and Domestic Commerce

industry recording the largest relative gain.

This index compiled by the bureau rose to 537 from 486 (revised) in August, comparing with 411 in September, 1942.

Electrical machinery shipments moved upward in September, the index rising to 476 from 453 (revised) in August, comparing with 286 in September, 1942.

Inventories index showed a slight increase in September—371.2, comparing with 366.8 (revised) in August and with 307.1 in September, 1942.

Field Reports on Business

Reports indicate that the backlog of war orders is sufficiently large to keep manufacturers of electrical equipment busy for some time. Considerable electrical supplies are required for equipping camps and bases. Housing construction is brisk. Retail trade is active at figures substantially above last year.

NEW YORK

A limited number of refrigerators, washing machines and electrical irons will be produced in 1944, according to WPB officials, but "there will not be any big opening up." Expected easing of the steel supply is given credit for the anticipated production plans, but the Office of Civilian Requirements emphasized that the program was subject to change on short notice.

At a meeting of the Edison Electric Institute in New York City this week the plans for the National Appliance Conservation Program for 1944, which will have as its slogan "Better Care—Less Repair," got under way. Starting in January, 1944, the campaign is designed to keep some 200,000,000 appliances functioning during the war period. The program will be sponsored by E.E.I. in co-operation with utilities, distributors, dealers and manufacturers.

Retail sales continue active. The Federal Reserve Board reported that department store sales rose 14 percent nationally for the week ended November 13 and 12 percent for the period from January 1 through November 13, compared to the comparable periods last year.

Civil engineering construction volume totaled $68,931,000 for the latest week, according to *Engineering News-Record*—10 percent higher than the previous week, but 31 percent lower than the corresponding 1942 week. Current week's volume brings the 1943 construction total to $2,848,861,000, which, on a weekly average basis, represents a decline of 67 percent over the $8,866,278,000 reported for the 47-week period in 1942.

NEW ENGLAND

A backlog of war orders is still on hand to keep manufacturers of electrical equipment fairly active for some time to come, although there is growing concern among smaller plants regarding restrictions on raw materials during the coming months. Distributors of the usual line of electrical apparatus required for the Christmas trade report almost complete cleanouts of common appliances except in those cases where stocks were formerly unusually large and where orders have been well spaced during the past year. One distributor has acquired odd lots of appliances from distant points, in one case a group of thirty 660-watt electric portable floor heaters and a fair-sized number of reflector floor lamps.

Central Maine Power has sold 140 "Ecco" milk coolers in the past twelve months and 20 others await government certification. Central Maine Power reports that a new box shop holding many Army orders at Richmond is being equipped with electric service to follow gas engine operation. The Sagadahoc Fertilizer Co., Bowloinham, is doubling its motor equipment. New England Power Service Co. has completed a 22-kv. overhead crossing with wooden towers over the Merrimack River at Haverhill, Mass.

Further airport developments which should add to orders for lighting supplies include additions to Rhode Island runways, costing $115,000, and a heating installation, which will cost $27,400. During the past month a larger number of motorized machinery and welders have appeared on the market after reconditioning.

PACIFIC COAST

Many electrical firms are affected by the recent more rigorous application of the manpower directives increasing their working hours. Wholesaler organizations have been well mobilized for service all year and have maintained a fairly stable equilibrium.

Orders and prospective orders include a low bid of $58,500 by Allis-Chalmers for instrument transformers for Vernita substation of Bonneville System; $19,450 of Bowie disconnect switches for Covington and Vernita stations; many camp and base electrical installations, of which $23,233 for naval air station at Santa Ana is typical; three airbase lighting jobs for Colorado, and $15,603 for G.E. pole line hardware for Bonneville system.

The city of Tacoma is requesting December 7 bids for $40,000 of control and telemetering equipment. The seventh generator at Grand Coulee is now commercially producing, raising the installed capacity to 700,000 kw. A million-dollar post-war market is estimated for raising electrical wiring standard of the 31,336 FHA homes built during past three years in northern California territory served by Pacific Gas & Electric Co. They average 18 to 31 outlets, whereas minimum red seal requirements would require a 45 to 50 average.

CHICAGO

Indications of a transition in industrial activity are growing almost weekly in the Chicago area. It is becoming increasingly apparent that the peak of production requirements for war is passing. During last week the army closed the Milwaukee ordnance plant which has been employing 5,000 persons in the manufacture of 0.50 caliber cartridges. Within the past two weeks 1,100 electricians have been laid off by Chicago electrical contractors. This represents about 20 percent of the total union electricians in the area.

Electrical manufacturers in this area report that orders from industrial concerns for switchgear, motor and control apparatus is off considerably for the current quarter compared with previous quarters of this year. These electrical firms agree, moreover, that no inquiries as yet have been received regarding postwar delivery of heavy electrical apparatus. Utility orders at the present time are confined to orders for equipment to supply new war industries in their service areas; small orders for repair parts and breakdown replacements.

One large electrical firm reported this week that manufacture of d.c. machinery, particularly motors and controls for shipboard service continue in good volume. Occasional shipments of large high-voltage power transformers are being made to allied governments, it was stated.

Second of a series of statements about ETL *comprehensive services*

COMPREHENSIVE SERVICES IN PROMOTION OF GOOD QUALITY IN LAMPS AND LIGHTING

ETL is retained regularly by certain large purchasers and from time to time by certain lamp manufacturers for the conduct of continuing life tests under controlled conditions at ETL headquarters and in service. These are the only independent tests of various makes of lamps made under identical conditions and available to those clients for whom the tests are made for comparison of lamp quality. Among clients who regularly utilize these ETL services are—

SOME TWENTY ELECTRIC UTILITY COMPANIES

THE MAZDA LAMP MANUFACTURERS

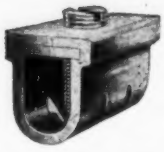
This is the second of the elements of ETL's *comprehensive services* in connection with lamps and lighting. ETL work attains to higher effectiveness than it otherwise could because it is coordinated with inspections and tests at the producers' plants, with research at ETL headquarters and with inspections and investigations in the field.

ETL services are available to any manufacturer and to purchasers of his product who care to avail of them.

ELECTRICAL TESTING LABORATORIES, INC.

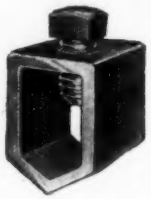
2 EAST END AVENUE AT 79th STREET, NEW YORK 21, N.Y.

Utility Engineers Wrote the Specifications for These Fittings



Wedge Grip Connectors, with V corrugations that grip wires securely.

Every one of these Sherman Solderless Wire Connectors reveals a thorough knowledge of the conditions under which they are used. They are built to meet the specific needs of the Electrical Industry—made, in fact, according to the recommendations of practical utility engineers.



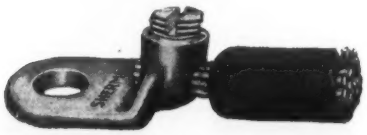
"Bond-Rod" Ground Clamp. Strong, one-piece construction. Cup point screw.

It pays to use Sherman Solderless Connectors, because they are practical, efficient, easy to install, and moderately priced.

Write today for catalog and list prices.

Split Bolt Connectors. Deep cut threads withstand heavy wrench torque. Extra long pilot. With or without nut retainer.

Type SO Solderless Lug. For heavy duty service. Serrated gripping surfaces hold conductor securely.



Type SM Solderless Lug. Inexpensive one-piece construction. Compact, simple, rigid. May be soldered.

H. B. SHERMAN MFG. CO.
BATTLE CREEK MICH.

Sales Opportunities

WASHINGTON—Pacific Power & Light Co., Portland, Ore., plans new 110,000-volt transmission line, including transformers of about 15,000-kw., switchgear and auxiliary equipment. Also has authorized immediate construction of new 66,000-volt line about 7 mi. long. Substation will be increased in capacity; transformers of 12,000 kw.

FLORIDA—War Department, Washington, D. C., has authorized new army air force base, comprising hangars, shops, and warehouses, with mechanical and electrical equipment. A power substation is planned, with distribution system. Program also will include barracks, mess hall and other service buildings, with electrical facilities and connections. Entire project will cost about $1,000,000, and will be supervised by U. S. District Engineer Office, Jacksonville.

KENTUCKY—Curtiss-Wright Corp., Airplane Division, Buffalo, N. Y., will carry out expansion in plant, including additional buildings, with machinery and electrical equipment for considerable increased output for government. Cost about $2,400,000, with financing by Defense Plant Corp. Work is scheduled to proceed at once.

ILLINOIS—Bureau of Yards and Docks, Navy Department, Washington, D. C., has taken over property and will remodel and equip for new storage and distributing depot, including mechanical and electrical equipment and facilities. Cost estimated about $500,000. Work will begin at an early date.

NORTH CAROLINA—Civil Aeronautics Administration, Washington, D. C., has plans maturing for new airport, comprising hangars, shops and other buildings, with mechanical and electrical equipment. Also power substation facilities, with lighting system, distribution lines, etc. Entire project will cost about $800,000.

IOWA—Corning Municipal Utilities, Corning, Bruce B. Watts, secretary and purchasing agent, will receive bids until December 7 for extensions in municipal power plant, including 1,000-hp., diesel engine-generating unit, with auxiliary equipment, additions to switchboard and other station accessories, voltage regulators, etc., as per specifications on file. Work is to be started on or before May 1, 1944. It is understood that project will have a priority rating.

FLORIDA—Civil Aeronautics Administration, Washington, D. C., plans early call for bids for new airport, comprising hangars, shops and other operating structures. Power substation facilities will be installed with distribution lines, lighting system, etc. Entire project will cost approximately $425,000.

TENNESSEE—International Harvester Co., 180 North Michigan Ave., Chicago, Ill., plans early construction of new plant on 250-acre tract of land acquired a number of months ago, to be used for manufacture of a new mechanical cotton picker machine and other agricultural labor-saving machinery. It will comprise several large one and multi-story buildings, with machinery and electrical equipment for heavy output. A power plant is planned. Entire project is reported to cost close to $5,000,000. Application is being made for a priority rating.

OHIO—War Department, Washing... D. C., has approved plans for new mili... cantonment, comprising shops, wareho... and other industrial structures, with ... chanical and electrical equipment. A... power substation with electrical distri... tion system. Project will include barra... mess hall and other service buildings, ... is estimated to cost over $1,000,000. Aw... for buildings has been made to Corbe... Construction Co., 220 East 42nd St., N... York, N. Y. U. S. District Engineer Of... Wright Field, Dayton, will supervise p... ect.

SOUTH DAKOTA—Electric Departm... Brookings, is planning a post-war exp... sion program at municipal power pl... with installation of additional equipm... including switchboard, instruments, ... Estimates of cost will be made soon.

TEXAS—Lone Star Steel Co., Inc., D... gerfield, will make extensions in plant ... production for government, including ... building with machinery and electri... equipment, estimated to cost about $1... 000. Financing by Defense Plant C... Work will be carried out at early date.

OKLAHOMA—Airport Department, Ok... homa City, has engaged Austin Co., 16... Euclid Ave., Cleveland, Ohio, engineer ... contractor, to prepare plans for propo... municipal freight air terminal on 2... acre tract of land near city, to be car... out as a post-war project. It will comp... a series of large hangars, shops, wareho... and other structures, with mechanical ... electrical equipment. Also control to... with beacon lights, power substation, un... ground conduit system, lighting insta... tion and other facilities. Complete proj... is estimated to cost close to $25,000,0...

GEORGIA—Bureau of Yards and Doc... Navy Department, Washington, D. C., ... take bids soon for new naval hospital, ... include power plant with complete el... trical services for group of institutio... buildings, underground and overhead ... tribution lines, exterior lighting system ... other facilities. Also refrigerating pl... mechanical laundry and other utility str... tures. Cost estimated close to $5,000,0... Robert & Co., Bona Allen Bldg., Atla... are architects and engineers.

ILLINOIS—General Motors Corp., Gene... Motors Bldg., Detroit, Mich., has contract ... with government for expansion in pl... comprising additional buildings with ... chinery and electrical equipment. En... program will cost about $2,200,000, w... financing by Defense Plant Corp. W... is scheduled to begin soon.

SOUTH DAKOTA—Water Departm... Clear Lake, will receive bids until D... cember 6 for motor-driven turbine pump ... unit, with capacity of about 50 gal. ... min., under a total lift of 165 ft., for wa... works station, complete with motor, con... and accessory equipment.

TENNESSEE—North American Ra... Corp., Elizabethton, plans expansion ... local mill, with installation of additio... machinery and electrical equipment for ... creased capacity of high-tenacity rayon y... for tire cord service. Project will hav... priority rating and is reported to cost ... excess of $1,000,000.

Even the Most Minute Part Has Its Big Moments

The contact points in a fighter plane's "turn and bank" indicators are not much for size, but they must be brutes for action. Like all component parts in a plane's electrical apparatus, they must function perfectly or spell trouble for the pilot. Always, he must be sure of his maneuver.

Under war need's pressure, a new type "turn and bank" indicator—an instrument in which the pointer remains stationary to show the degree of deviation from normal flight—called for contacts capable of operating 75 times a second, but extremely sensitive. Tiny contacts they are, less than a tenth of an inch in diameter, but they make and break the circuit that controls the speed of the gyroscopic motor.

Early in the designing, Mallory contact experience was sought. Standard contact materials set up excess arcing, creating unwanted radio interference. Then Mallory metallurgists, working against time, developed a combination of metals—standard tungsten for one point, Elkonium-34 for the other—that licked the problem in jig time. Just one contribution to the development of accurate combat maneuvers, to be sure, but an excellent example of how concentrated cooperation is functioning to insure that even the most minute part does its bit at the critical moment.

Mallory's years of contact experience and "know how," stimulated by war production demands, are furnishing innumerable solutions to perplexing problems of contacts and contact assemblies. Many of the applications developed in the Victory effort have significance for the future.

When you have contact problems, bring them to Mallory.

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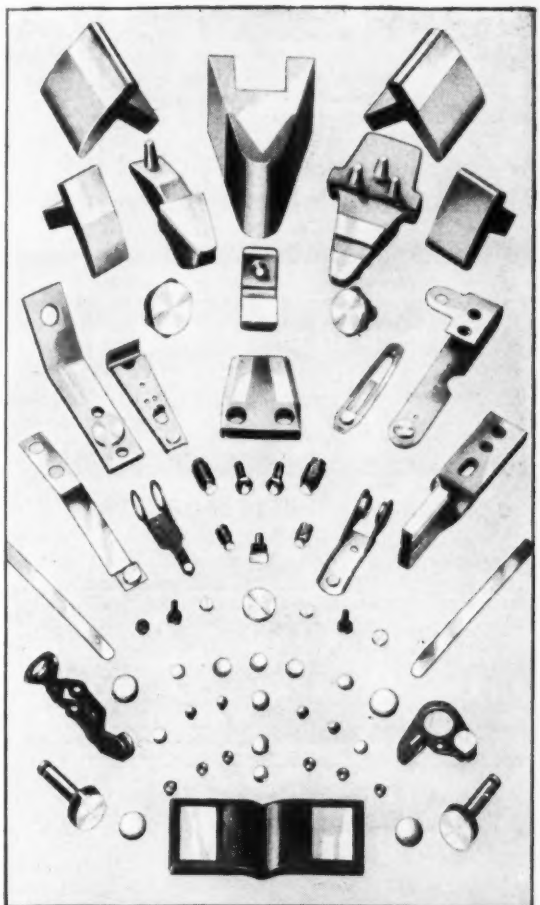

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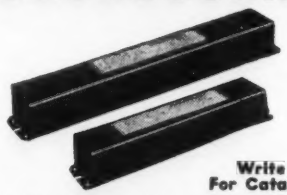

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LETTERS TO THE EDITOR

Opportunity

To the Editor of ELECTRICAL WORLD:

Just having read the editorial "Opportunity" in the October 2 issue of ELECTRICAL WORLD brings the thought that we have all read, discussed, considered, tried, rejected and failed with innumerable plans and policies to restrict the ill effects of corporation and organized labor shortcomings and improprieties, and we have tossed innumerable tons of verbal straw regarding Opportunity, the American Way, Free Enterprise.

Why don't we try the simple expedient of discontinuing the fining by taxation of American enterprise and transfer our restrictive political action to the fining and discouraging of land speculation?

To do that would be to open up the field of opportunity to all the boys coming home and we wouldn't have to do it by pitting class against class.

JOSEPH S. THOMPSON, President,
Pacific Electric Mfg. Corp.
San Francisco, Calif.

•

Copper Nails Do Not Kill Trees

To the Editor of ELECTRICAL WORLD:

It is a common thought in the electric industry that a copper nail or staple driven into a living tree will cause it to die.

In 1939 I drove six 8-d nails into a sassafras tree which was then about 2 in. in diameter and also into a red oak tree which was about the same size. The nails were driven about 1½ in. into the tree and as far as I can observe today they have had no effect whatever on the growth or life of the tree.

I was very careful in driving the nails not to strike the bark of the tree. As you probably know, the life of a tree is dependent on the epithelium layer which is between the outer bark and woody portion of the tree. If this epithelium layer is damaged it will affect the life of the tree.

It is quite possible that a nail of any kind driven into a tree might make an entrance place for rot and disease, which might eventually cause the death of the tree. This would be a case similar to that of a man who would be scratched with a pin and would die of blood poisoning. Ordinarily a healthy tree will quickly heal any small punctures made in the bark, so that the idea

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of a tree being killed by a copper nail is simply superstition.

A tree might even pick up a minute amount of copper salts from the copper oxide, but these copper salts are not damaging to tree growth.

I believe the above to be the general scientific conclusions on this problem, *i.e.*, that the kind of material—copper, steel, brass or any other metal—shows little if any effect on tree health. Trees that have been allegedly killed by driving a copper nail into them have probably had the epithelium layer damaged by hammer blows striking the bark.

EDMUND D. KENNEDY,
Advertising Manager
Copperweld Steel Company,
Glassport, Pa.

•

New Funds Allotted for Rural Projects

The Rural Electrification Administration has recently announced allotments totaling $1,515,000 to thirty systems in twelve states, bringing total REA allotments to $471,485,973, of which $4,539,678 represents operations during the current fiscal year.

The largest single allotment, to the Brazos River Transmission Electric Co-operative, Fort Worth, Texas, is for $500,000 which is the balance of a previous allotment of $1,500,000. This money will be used to provide additional generating and transmission facilities in an important war production area.

The other allotments, for the most part, will be used to extend service to farms qualifying under present WPB regulations permitting connections to nearby power lines of farms producing livestock, dairy and poultry products. In announcing the loans, Administrator Harry Slattery said that no new construction would be undertaken except in accordance with authorization or regulation of WPB.

Included are the following:

COLORADO—San Isabel Electric Association, Inc., Pueblo, $45,000.

ILLINOIS—Illinois Valley Electric Co-operative, Inc., Princeton, $25,000.

IOWA—Maquoketa Valley Rural Electric Co-operative, Anamosa, $75,000; Butler County Rural Electric Co-operative, Allison, $70,000; Ida County Rural Electric Co-operative, Ida Grove, $50,000; Buchanan County Rural Electric Co-operative, Independence, $50,000; Hancock County Rural Electric Co-operative, Garner, $45,000; Winnebago Rural Electric Co-operative Association, Thompson, $35,000; O'Brien County Rural Electric Co-operative, Primghar, $25,000.

KANSAS—Central Kansas Electric Co-operative Association, Inc., Great Bend, $40,000.

MINNESOTA—Peoples' Co-operative Power Association of Olmstead County, Roches-

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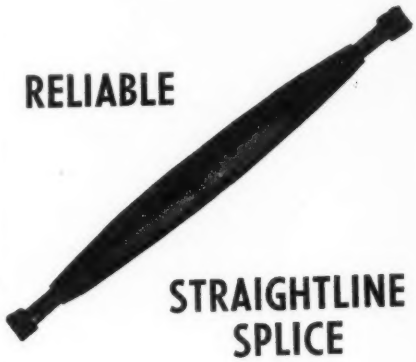

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ter, $60,000; Nobles Co-operative Electric, Worthington, $40,000; Southwestern Minnesota Co-operative Electric, Pipestone, $30,000; North Pine Electric Co-operative, Inc., Finlayson, $25,000; Traverse Electric Co-operative, Inc., Wheaton, $20,000.

MISSOURI—Ozark Electric Co-operative, Mt. Vernon, $75,000.

NEW YORK—Delaware County Electric Co-operative, Inc., Delhi, $15,000; Chautauqua-Cattaraugus Electric Cooperative, Inc., Cherry Creek, $10,000; Oneida County Electric Association, Bouckville, $10,000.

NORTH DAKOTA—Nodak Rural Electric Co-operative, Grand Forks, $45,000.

OHIO—Marion Rural Electric Co-operative, Marion, $25,000.

SOUTH DAKOTA—Whetstone Valley Electric Association, Inc., Milbank, $20,000; Union County Rural Power Co., Elk Point, $15,000.

TEXAS—Comanche County Electric Co-operative Association, Comanche, $50,000; Gladewater Electric Refrigeration Co-operative, Inc., Gladewater, $25,000; Upshur Electric Refrigeration Co-operative, Inc., Gilmer, $25,000; San Bernard Electric Co-operative, Bellville, $20,000; DeWitt County Electric Co-operative, Inc., Cuero, $8,000.

WASHINGTON—Columbia County Rural Electric Association, Inc., Dayton, $37,000.

Manufacturers Make New Assignments

Electrical manufacturing companies have recently announced the following appointments to their staffs:

Solar Capacitor Sales Corp. has appointed J. E. McKinley with offices at 401 No. Broad St., Philadelphia, Pa., as sales representative in eastern Pennsylvania, Maryland, and the District of Columbia.

To provide for better representation in various parts of the country where war production has opened new plants or greatly increased activity, Cannon Electric Development Co., Los Angeles, Calif., has appointed the following new engineering representatives: E. B. Glenn, 801 Healy Bldg., Atlanta, Ga.; Douglas H. Loukota, 10 Light St., Baltimore, Md.; Ray Perron & Co., Little Bldg., Boston, Mass.; H. M. Welch, Crosby Bldg., Buffalo, N. Y.; George Sturman, 712 Sixth Avenue S., Minneapolis, Minn.; J. Tinsley Smith, 108 Seventeenth Avenue S., Nashville, Tenn.; J. W. Beneke, St. Louis agent for E. L. Melton, at 575 Arcade Bldg., St. Louis, Mo.

Wheelco Instruments Co., Chicago, has strengthened its New England representation by the appointment of the Cochrane Steam Specialty Co., Boston, to serve with George W. Hall, the company's present representative. The Cochrane organization and Hall now serve Massachusetts, Rhode Island, Maine, New Hampshire, Vermont and parts of Connecticut east of the Connecticut River. C. L. Clark, formerly connected with the company's Cleveland office, has been placed in charge of a western New York office in Buffalo. Charles D. Mount has been named sales and service representative for southern Ohio and northern Kentucky, with headquarters in Cincinnati, while H. E. Holling has been appointed northwestern Illinois representative with headquarters in Peoria. The Lang Co., Salt Lake City, has been appointed sales and service representative in Utah, Idaho, Wyoming and Nevada.

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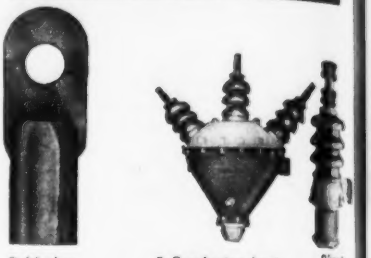

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He likes to write. It's not painful for him to sit at a desk and pour out words describing installations he has seen—what engineers say about the products they use and the kind of information they need to help them do their jobs better. He expresses himself clearly on paper and enjoys doing it.

He has written advertising, sales promotion or publicity for a manufacture, or publication—maybe not a lot, but enough to get the taste of printer's ink and to like the flavor.

He knows something about research methods and statistical analysis . . . can work up a pretty acceptable questionnaire, and handle the procedure of mailing, tabulating returns and interpreting.

He's 25-35 . . . has a natural curiosity that will make him learn rapidly and grow in his job. He's a nice guy to have around and gets along well with his fellow workers.

The job is in the Sales Promotion and Market Research Department of two of McGraw-Hill's leading publications. If you're interested in the job and possess enough of the above qualifications to put you in the running, let's hear from you promptly please.

Market Research Dept.

Electrical World

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General Electric Forms Credit Unit

General Electric Credit Corporation has been organized as a financing subsidiary of the General Electric Co., under the banking law of New York State, and will broaden the scope of activities carried on since 1933 by General Electric Contracts Corporation, whose business will be assumed by the new organization. The contracts company engaged principally in financing the sale of consumer goods. The immediate function of the new company will be to provide financing for war construction and production work in connection with contracts which involve use of products manufactured by General Electric and affiliates, and of parts produced by others for incorporation in such products.

Management of the new company will be the same as that of the contracts company, of which George F. Mosher is president, and the main office will be at 570 Lexington Avenue.

After the war the new company not only will provide financing for the purchase of consumer goods but also will furnish increasing credit facilities to purchasers of other products made by General Electric Co. It is expected that the financing of sales of home appliances made by General Electric will assume even greater proportions then, Mr. Mosher said.

•

York Bonds Offered

Public offering has been made of $4,500,000 of 4¼ percent first mortgage sinking fund bonds of the York Corp., due 1958. The bonds were priced at 102½ percent. Net proceeds of the issue will be used for the redemption before April 1, 1944, of the outstanding $3,913,000 first mortgage 6 percent bonds, due 1947, to pay in full $378,550 notes to banks and others, to retire miscellaneous other indebtedness and to reimburse the company for disbursements heretofore made for the retirement of the 6 percent bond issue.

•

Trebles Plant Facilities

Ferranti Electric, Inc., has moved its manufacturing division to a modern fireproof sprinkled building located in the downtown section of Brooklyn, N. Y., where it is now occupying three times the floor space utilized in the building formerly occupied in Manhattan, N. Y. The company has announced that the Manhattan quarters became much too small to take care of a rapidly expanding volume of business.

NEW SMALL RADIUS BENDERS STOPS KINKS

Forming small-radius bends in tubing, conduit or pipe, without wrinkles, kinks, or serious distortion is a simple task with Greenlee Hand Benders. They form neat bends for sharp nooks and corners . . . eliminate manufactured bends and fittings . . . save up to 75% in time and material on many jobs. Special clamping device prevents slipping . . . stops kinks. Available to essential users, Model No. 761 bends pipe and rigid conduit (IPS); No. 763 handles steel, copper, brass, and aluminum tubing; No. 764 for thin-wall conduit (EMT). *Write for more information—ask for new circular S-120.*

NEAT BENDS ENHANCE APPEARANCE OF JOB!

Shown above is a series of bends in thin-wall conduit made with a Greenlee No. 764 Bender. These smooth, small-radius bends eliminate fittings and provide a finished appearance to the job. On this high-production machine, fittings were used only at the end connections.

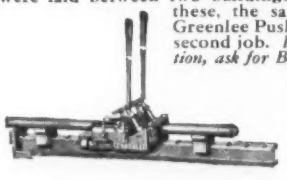
COMPLETE LINE OF BENDERS

For any bending job there is a Greenlee Bender, including powerful hydraulic benders for conduit pipe and tubing from 1¼" to 4½" size. They are easily operated by one man and are compactly built into one unit. They save the cost of many manufactured bends. Portable, they are easily carried to the job and set up.

HYDRAULIC PIPE PUSHERS

Here is another Greenlee tool that saves hours of work and conserves manpower. When installing iron pipe or concrete duct underground, use a Greenlee Hydraulic Pipe Pusher. It's the only fast, easy method of installing pipe without tunneling, without digging or backfilling long trenches, without cutting pavement or tearing up road beds.

As shown at right, only a short trench is needed to accommodate pusher and pipe. One man can operate. Here, with a Greenlee No. 790 Pusher, 4" pipe was pushed a distance of 55 feet under the double, main-line tracks of railroad. Thru pipe main power lines were laid between two buildings. On jobs like these, the savings pay for a Greenlee Pusher on the first or second job. *For more information, ask for Bulletin No. 5-117.*



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BOOKS RECEIVED

Supervision of Governmental Employees. By Alfred M. Cooper. McGraw-Hill Book Company, New York. 202 pages. Price $1.75.

A conductor of training conferences analyzes the supervisor's problems in selecting personnel, maintaining their health, safety and morale and capacity for holding public confidence. There are sections on judicious delegation of authority to and the qualification of subordinates. The new group of governmental utility systems are appropriately recognized in a treatment which naturally differs from many devoted to private enterprise.

Patent Law for Chemists, Engineers and Students. By Chester H. Biesterfeld. John Wiley & Sons, Inc. 225 pages. Price $2.75.

Evolved from a course of university lectures, the treatment is geared to both the needs and the capacity of technical men who may well encounter patent law even if they never invent, because few enterprises can escape the contact. Citations avert stilted legal verbiage, presenting the precedents simply. Typical topics are priority, originality, functional claims, reissues, infringement, interferences, licenses, trade secrets, searches. Courts are reported invalidating over 80 percent of patents; it behooves technical men to watch the trend. This book should help.

Piping Stress Calculations Simplified. S. W. Spielvogel. McGraw-Hill Book Company, New York. 83 pages, illustrated. Price $2.50.

Here are the formulas, tables and principles on which the metropolitan utility author also bases the numerous completely computed examples. Each problem is analyzed in terms of moments and points of inflection for plane and three-dimensional linears and bends. Variable flexibility is likewise tabulated in detail. Appendices afford allowable stress values for numerous metals and for temperatures up to 1,000 F.; also derivations of basic formulas.

Basic Radio Principles. By Capt. Maurice Grayle Suffern. McGraw-Hill Book Company, New York. 271 pages, illustrated. Price $3.

Any one looking longingly at industrial electronics will find in this signal corps author's book on radio circuits an explication of circuit functioning that is simple, lucid and helpful. It refrains from assuming that the reader knows what coupling, voltage-doubling, grid-leak, oscillation, alinement, volume control and regeneration are. Frequency modulation is merely mentioned in this vocational guide written without a formula or equation.

How to Maintain Electric Equipment. Published by General Electric Company, Schenectady, New York. 372 pages. Over 500 illustrations. Price $1.75.

Emphasis placed on maintenance practices to help industrial plants get maximum performance and longest life out of their electrical equipment. Preventive-maintenance inspection schedules and trouble-shooting charts are included for nearly all types of equipment, beginning with battery trucks and concluding with welders. Although some charts are for specific types of General Electric Company's apparatus, nevertheless they are general in nature so that the maintenance man can use them as a guide. Ten pages contain general technical data and treatment for electric shock. Prominent marginal headings provide ease in finding the material for the respective equipments.

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NEW ADVERTISEMENTS received by Monday will appear in Saturday's issue, subject to limitations of space available.

EMPLOYMENT SERVICE

SALARIED POSITIONS — This advertising service of 33 years' recognized standing negotiates for high salaried supervisory technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commissions. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo, N. Y.

POSITION WANTED

ENGINEER, 46, Spendid health, married, college graduate, 23 years experience all phases Public Utility work, electric and gas, power plant operation, desires connection making use of experience. Excellent references. PW-614, Electrical World, 330 W. 42nd St., New York 18, N. Y.

WANTED

ANYTHING within reason that is wanted in the industry served by Electrical World can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

AVAILABLE

ASSISTANT TO BUSY UTILITY EXECUTIVE

To the assistance of an over-worked utility executive, I offer Intelligent, Qualified Help!

I am young—41 years old—good health—team work personality—ambitious.

Experience—20 years—well grounded background in accounting, sales promotion, rate analysis, operation, construction and management of electric, gas and ice properties.

Now employed but am looking for a connection offering a Future for Ambition and a Present with more pleasant environment for my family.

PW-620, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

WANTED

CHIEF INSPECTOR

We have an excellent opening in one of our Massachusetts plants for a Chief Inspector or Quality Control Engineer to make laboratory investigations of company products, conduct special tests in our factories and assist in setting up Inspection and Quality Control systems.

Prefer man with previous quality control experience in the electrical field. Should have electrical engineering degree or equivalent in experience and must be familiar with electrical measuring instruments.

This position offers a real future to the right man. Salary commensurate with training and experience.

Mail a resume, giving your experience and education and salary desired to start and an early interview will be arranged with qualified applicants. All replies strictly confidential.

Sylvania Electric Products Inc.
Industrial Relations Department
254 Essex Street, Salem, Mass.

POST-WAR ENGINEERS

1 Electrical

1 Mechanical

NEEDED NOW

● WANTED as assistants to Chief Engineer of long-established, international organization.

The right men, with either or both electrical and mechanical engineering and design experience and demonstrated creative ability in the development of machine products for industry, will command good salaries.

The positions are with an alert and progressive manufacturer now engaged in vital war work and long recognized as a peacetime leader in its field.

Congenial working conditions in a pleasant community forty miles from Chicago. Send us your complete background; we will hold it in strictest confidence.

P-622, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

Additional Position Vacant

Advertising On Pages 121 and 132

We have the following equipment for sale and prompt removal, at a very attractive price. This equipment is guaranteed to be in good condition—equally as good as new as it has been used very little, and can be inspected at your convenience.

RIDGWAY ALTERNATOR GENERATOR

No. 583 Design 60V03, 312 KVA 80% Power Factor 250 KW 480 Volts—3 Phase—60 Cycles 3F6 Amperes per terminal. 180 RPM Field Current 46 Continuous Rating
Ridgway Dynamo & Engine Company
Ridgway, Pennsylvania
With complete Control Board, Switches, Meter, etc.

EXCITOR FOR RIDGWAY ALTERNATOR GENERATOR

No. 4179 Design 9E16 Rated 12½ K.W. 1200 RPM 50 Amps—250 Volts—Adjusted for 250 V. full load
Ridgway Dynamo & Engine Company
Ridgway, Pennsylvania
Used with items listed above.

WESTINGHOUSE VOLTAGE REGULATOR & BOARD
(Not including Meters)

Made by Newark Works, Newark, N. J.
Type AE-1 for AC Current
Regulator adapted to AC 100-120 Volts Cycles 25-60 when used
Exciter Volts 90-127
With Resis Box style—Drwg. 485427
Style N-153191—Serial 771998
Label 3673, Feb. 8, 1926—Used in connection with items above.

WATER TURBINE WHEEL, COMPRESSOR, AND GOVERNOR COMPLETE

Used for Operating Items listed above.

DAVIS JUNK & SALVAGE CO.
Jones & Gifford Ave. Jamestown, N. Y.

SPECIALS

1—1000 KVA Pittsburgh 3 phase 60 cycle transformer 66,000 volts to 7200-6647 delta 12470-11500 wye.

1—1000 KVA Pittsburgh 3 phase 60 cycle transformer 66,000 volts to 2400-4160 wye.

3—667 KVA G.E. type H form KDDJ 60 cycle single phase transformers 16,000-14400 v. to 2300 v.

Prices quoted on request

ATLANTIC TRANSFORMER CO.
5143 N. 2nd St. Philadelphia 20, Pa.

OPPORTUNITIES!

in

New and used equipment recently released from service by a number of electric and gas utility companies.

POWER PLANT EQUIPMENT
CONSTRUCTION EQUIPMENT
SUBSTATION EQUIPMENT
TRANSMISSION LINE MATERIALS

Send for new list, . . . to

APPARATUS EXCHANGE
EBASCO SERVICES INCORPORATED
Two Rector St. New York, N. Y.

WANTED

ELECTRICAL ENGINEERS

With An Eye To The Future

If you are not now utilizing your highest skill for the war effort and are desirous of becoming associated with a busy but congenial organization whose long-range plans for the future offer solid engineering opportunities to really capable men, then investigate these four unusual openings with SYLVANIA ELECTRIC PRODUCTS, INC.

SUPERVISOR OF INCANDESCENT ENGINEERING—Will supervise and direct the engineering involved in the design, development and initial manufacture of incandescent lamps.

DESIGN ENGINEER—To work on the design, development and initial manufacture of ballasts and switches as well as design electrical circuits for lighting products.

TEST ENGINEER—To design test equipment used in testing lighting products. Will supervise and conduct tests on laboratory products.

FACTORY ENGINEER—To work on shrinkage, quality, other production problems involved in the manufacture of lamp filaments. Man should have a knowledge of chemistry as well as electrical engineering.

Applicants for these positions should have a degree in either electrical engineering or physics and at least five years engineering experience of an important nature, requiring the use of independent judgment and thorough-going analysis of electrical engineering problems. Previous related experience highly desirable but not essential.

In addition to the above positions, we have other good engineering openings offering real promotional possibilities and an opportunity to broaden your knowledge and grow with us.

If you would like to participate in developments that will later play a vital part in raising the American Standard of Living, won't you send us enough information about your technical education, training and experience, and salary requirements to warrant an early interview.

SYLVANIA ELECTRIC PRODUCTS INC.
Industrial Relations Department
254 Essex Street **Salem, Massachusetts**

—TRANSFORMERS—

BOUGHT and SOLD

We have several thousand transformers in stock for prompt shipment, and invite your inquiries.

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes.

One Year Guarantee

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI 27, OHIO

FOR SALE

One 50 H.P., 220 V., 3 phase, 690 R.P.M. Allis Chalmers motor; One 4 phase switch board; one Deane water pump size 8 x 10.
Make offer on any or all.

A. A. McAllister & Sons' Co.
Covington, Va.

FOR SALE

B X CABLE

Large quantity, 14-3 wire.
Make best offer per 1000'.

FS-621, Electrical World
330 W. 42nd St., New York 18, N. Y.

IF THERE IS

Anything you want

that other readers of this paper can supply

OR—

Something you don't want

that other readers can use, advertise it in the

SEARCHLIGHT SECTION